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Correction Copy

THE

DISSECTOR'S MANUAL.

A NEW EDITION,

WITH ADDITIONS AND ALTERATIONS,

By JOHN F. SOUTH,

LECTURER ON ANATOMY AT ST. THOMAS'S HOSPITAL.

> "Primò, nomina per ostensionem rerum discere necesse est; deinde res per nomina tenendæ, ordinandæ, revocandæ sunt."—GALEN.

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The present edition is, for the most part, a reprint of Mr. Green's "Dissector's Manual," published in 1820. It differs, however, in having a description of the Bones; without a knowledge of which, the anatomical student will always find himself perplexed in endeavouring to obtain an acquaintance with the attachments of muscles. The directions for the best mode of displaying the different parts, have been enlarged, and the relative situation of the muscles, with their uses, described sufficiently to enable the student to find them with greater facility.

Some portions of the section on relative situation have been introduced into the body of the work, with the exception of which, that part has been withdrawn; it being intended at an early opportunity to make another volume, specially appropriated to the dissection of parts in their relative position.

J. F. S.

34, *Stamford Street,*
Oct. 1, 1825.

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INTRODUCTION.

Anatomy may be regarded either as an independent science, or as subservient to the purposes of medical and surgical practice; each therefore demanding for its acquirement a different mode, according as the one or the other may be the object of the student. The present work is appropriated to Anatomy as adapted to practical uses, its aim being to point out all those objects which most require the attention of the beginner in this point of view.

From the different plans by which the ends above-mentioned may be attained, we have selected the one which experience has led us to prefer as uniting the most important practical advantages. This union appeared most attainable by taking the mean between two extremes, that, namely, of being determined wholly by the local relations; and that of dividing the whole body into the several systems of muscles, vessels, nerves, &c. and of pursuing each by itself with an almost entire neglect of its relative positions to the parts of other systems. We have endeavoured to combine the advantages of both, by so far availing ourselves of the former, as not to neglect the blending of the structures which compose the different portions of the body, while we adhere to the latter in tracing the several components of its structure distinctly and separately; so as to prevent on the one hand the confusion that would arise in consequence of frequent and rapid transitions from one part to the other, and yet on the other hand to preserve a facility of recombining the whole in the mind's view, while the relative positions are fresh in the memory.

Anatomy, like other sciences of experiment and observation, has become, by the industry of its cultivators, a collection of numerous, but too often insulated facts; and our ignorance of their meaning and connection has become apparent in proportion to their number. This condition of the science has influenced its language:—names have been multiplied, which neither describe nor explain, and different names, that owe their introduction to the mere caprice of the individual anatomist, have been applied to the same parts. Description has been exhausted, without adding to our knowledge, and without reference to the importance of structure and function.

The number of objects which must be attended to, in order to the acquirement of the necessary theoretical knowledge of medicine and surgery, is such that the greater part of the students, who visit the hospitals of the metropolis, can devote but little time to any single branch; and in addition to the theoretical part, the field of practice, which an hospital affords, claims a large portion of their time. But the state of the science, and the circumstances of the student, are not perhaps the greatest bars to improvement. The small progress too often found, and the perplexity of the student during that progress, are still more attributable to his want of previous information how to arrange the numerous but single facts which are offered to the mind; so that he is obliged to be seeking for a plan during the period he should have been acquiring the materials that are to fill it up; and by the time he has prepared it, the period allotted for his studies is expired.

It is in this respect that lectures are not only valuable but indispensable. In them a comprehensive idea is gained of the whole; and whilst the parts are displayed, their functions in the healthy state, and the importance of particular structures, are adverted to, with the changes which they undergo from morbid actions or from accident. Thus by forming the groundwork of physiological and pathological knowledge, the lecturer enables the student to pursue his anatomical labours intelligently.

But it must be recollected that lectures, however necessary, are only calculated to give general ideas; whereas it is required of the practitioner, that his knowledge should be particular and even minute. It is not sufficient that he is merely acquainted with the presence of certain parts, but he must know precisely their situation and extent. The surgeon's knife may give health or death within the space of one hair's breadth. This kind of knowledge is to be acquired by actual dissection alone. Idleness may persuade, and the natural aversion to the sight and touch of the dead, may enforce an opinion, that anatomy is to be gained at the cheap rate of turning over the unsoiling pages of a quarto, or learning by rote the names of muscles, arteries, or nerves, arranged in the convenient form of tables. The deception is not a little strengthened by the fallacious clearness which the art of the draughtsman and engraver, naturally interested in the *beauty* of the works, has given to those parts which the practical anatomist, more especially if a beginner, is at pains to discover, and often in vain labours to show distinctly, much less to exhibit with elegance. These means indeed may give an outline of the systems of parts, and are as such valuable; but practical anatomy aims at much more. Its leading object is to gain a thorough acquaintance with Relative Position,—a knowledge, by means of which the mutual relation of all parts of the body may, as occasion shall need, be represented to the mind. It can only be acquired by separating the coverings of important parts, by observing the manner in which they lie embedded in the surrounding softer parts, and the prominent points which mark their situation, whether seen in the living state, or viewed by dissection. The parts must be seen as connected with one another; not as at a lecture, where the body is generally prepared to show some single part, while every other which might obscure it is removed, in order to render it distinct in a large anatomical theatre.

The benefit and necessity of actual dissection does not, however, stop here: it would be well for the surgeon who intends to be a good operator, (and such, it is to be hoped, all do who undertake the profession,) that he should dissect, in order to attain that dexterity essential to most, and praiseworthy in all, operations. Minute dissection is frequently depreciated, or at best thought necessary for those only who profess anatomy as an independent science. It certainly is to be deprecated if it excludes more important occupation, or if the preference be given to the tracing of a minute fibril of a nerve, or ramification of a blood-vessel, while the relative position of the trunks is neglected. But barring the consideration that no part of the body is unimportant, minute dissection (as we have suggested) is of advantage in giving to the hand facility of motion and exact correspondence with the will. Neglect of dissection, of which the contempt of minute anatomy is but a symptom, is not, however, the evil of most common occurrence. It is more requisite to warn against the slovenly method of performing it, both from the imperfect impression which it may occasion at the time, and the injurious habits it may be the means of forming. Those so erring, should recollect that the diligence of the dissector is not to be estimated by the quantity dissected, but by the knowledge acquired and retained; and that, in the necessarily slow and tedious process of dissection, the sum of such knowledge as merits the name will be commensurate with the quantity of examination and the degree of observation and activity of the mind. Nor will the relative position of parts in the dead subject alone satisfy the zealous dissector, whose final aim is that of medical and surgical utility. He will extend his observations and comparison to the living body. The simple circumstances of handling the living or recent body, of feeling the hard parts through their coverings, of observing the form and motion of joints in this state, have been, as it would seem, too much neglected; but their advantages may be appreciated by those who have felt the difficulty of detecting unnatural conformation or figure, whether arising from disease or injury. An extensive opportunity of enlarging his comparative views, and one which should be cultivated by every means, is afforded in the dissecting-room by the inspection of bodies, and thus of learning to discriminate between the appearances of health and disease, and of ascertaining the changes which disordered functions or morbid actions produce in the form, colour, and texture of organs. Of the advantages which result from such observations to our knowledge of the causes, signs, seats, and treatment of disease, it is not here the place to treat.

These then are the chief benefits which are to be expected from dissection; and whilst the lectures give a comprehensive view of the subject, with the mutual relation and connection of all its parts, and their application to practice, it is by dissection alone that such views become essentially our own, or that we dare give them the name of knowledge.

After having fixed the objects of inquiry, the next important and necessary step in the advancement of knowledge, is to determine the method of investigation. To this end the following considerations are recommended to the attention of the beginner:—He must depend for success entirely on his own exertions; and guard against the common error of supposing that his acquirements will be proportionate to the lessons of his teachers, if he give even attentive ear to them, without activity of mind: for he must recollect that the mind is by no means passive in the acquirement of knowledge, and that, to use the common but apt metaphor, before we have digested what is presented to our perception, we can on no account call it experience.—Every mind has something individual in its mode of receiving instruction, and of stamping form upon it. That which is presented to the mind, must be rendered consonant with it, assimilated, or in other words, reduced to principle, before it can become an understood fact, or a fit maxim for conduct or judgment. In the eagerness for knowledge, he must be careful not to overburthen the mind, by heaping fact upon fact, without examination or principle, for it cannot retain more than it can arrange.

He should have a general conception of parts before he proceed to their particular examination; he should not therefore attempt to dissect those parts which he has not seen displayed in the lectures or demonstrations. If invention were a quality frequently to be met with, such a rule might be dispensed with; but, fortunately or unfortunately, man is the creature of imitation and education; he may therefore lose his time, from groping in the dark, when he might have carried a light to the inquiry; and from his attempts having been repeatedly foiled, he may become tired and disgusted with his employment. A general idea is to the young anatomist what a map is to a traveller in a strange country.

But the student, who should indiscriminately direct his attention to all the parts which are successively treated of in lectures or in books on anatomy, misled by the necessity under which the writer or lecturer lies of describing all parts, and almost with equal minuteness, will find, from insufficiency of time, that notwithstanding all the efforts he may have used, he is deficient in points which are essential in practice, whilst he has gained others for which he has no application. There is necessarily a choice of subjects to be made, as well as a plan to be pursued in their investigation: and although it is not meant that there are any parts of the body which are unworthy consideration, yet it is recommended that the leading points should be first mastered; and that afterwards, as time and opportunity may permit, the less important should be added.

Thus the student should commence with the bones: they ground, and in part predetermine, the scheme of relative position; they form a framework to all the softer parts; and in giving them figure and support, constitute the form of the body. From their unyielding texture, they may be readily distinguished by the touch, although hidden to the sight when surrounded by the softer parts; they therefore serve as a guide to these in the neighbourhood. The form of the ends of bones, with their means of adaptation to each other, is, perhaps, the most essential part of their study. An accurate knowledge of these assists greatly in the diagnosis of the often obscure fractures about joints, and is indispensably requisite in that of dislocations. In these cases particular attention is requisite to their figure, more especially when surrounded by the soft parts, to the prominent points which may be felt under such investments, to their capability of motion, to the strength of their articulation, as depending upon the form of the bones or cartilages, and the strength, number, and disposition of the ligaments. These circumstances, together with a knowledge of the muscles, explain the manner in which displacements occur, and the means of their reduction.

The muscles are considered as contributing to the form and contour of the body, giving the inequalities to its surface, by the prominences of their fleshy bellies and the depressions between them. Nor are they less important, as forming the beds for the reception of the vessels and nerves, and thus, while they point out the course of the vessels, assisting in the ready discovery of these: nor can we overlook their influence on the bones and joints, in preventing pain, deformity, and failure in the treatment of fractures and dislocations. It becomes therefore a point of high practical importance that their situation, attachments, and relative position should be mastered.

Nor does the anatomical examination of the organs situated within the large cavities of the body require a less particular attention, as they may have injury communicated to them, or may be the subject of disease, which must be often determined in a great measure from situation alone. Their appearance should be observed, and its shades of difference discriminated, that health and disease may be recognised under every form.

But above all others, perhaps, whether for the purposes of the general practitioner, especially in midwifery, or the more immediate functions of the surgeon, do the organs of generation, both in the male and female, demand attention: they are extensively connected with diseases, the treatment of which involves a variety of operations, from the simplest to the most complicated; but all requiring an intimate knowledge of their structure and relative position, and all intimately concerning the health and safety of the patient.

We have omitted no opportunity of attracting the attention to relative position. But important as this is in all parts, it is of especial importance in dissecting the arteries. In the following work, therefore, we have enumerated the parts in the neighbourhood of which they take their course, and shown their situation with respect to these parts. Thus the student will be enabled to notice where compression may be easily employed; to seek the points where they run over bone, where deeply embedded betwixt muscles, or where they are superficially placed. He will likewise attend to their chief anastomoses, so that he may duly estimate the power of preserving life in a part, by their enlargement, when the principal trunk supplying it has become obliterated. The importance of familiarizing the mind and eye with their situation in the planning and executing of operations, and the utility of a previous acquaintance with the accidents to which they are liable, together with the ready way of detecting them, must be obvious: for, without a previous knowledge of the exact position of the arteries, the obscurity occasioned by the hæmorrhage at the time of their injury, renders their discovery doubly perplexing. It scarcely need be added, that the larger branches are those which particularly claim attention; for, however by the dissection of the minute ramifications, the industry of the student may be displayed, or by learning their names by rote, he may astonish those who delight rather in the semblance than the reality of knowledge, yet, beyond their contingent advantages in aiding the acquirement of decision and dexterity in operation, they are rather to be deprecated than recommended.

Less obvious, but scarcely less important, is the claim which the Nerves have on the student's attention, not only that they may be preserved from injury and avoided by the knife; but likewise because, by examining their distribution, we gain more accurate notions of disease, of the possible relations between distant parts, and the general harmony of the animal economy.

These, therefore, are the parts which have been investigated in the present work as systems, or traced throughout the body:—they are the elements, as it were, of anatomical knowledge. But, these being known, another mode of inquiry presents itself, that of examining the blending and interlacement of these parts together, as they are entering into the composition of the different portions of the body. It is from understanding this grouping of parts, that we are enabled to plan and foresee all the steps of an operation, or note the reasons why it may not be undertaken; whereas, without this investigation of them as a whole, our acquaintance with the individual and insulated systems can neither give us confidence, nor the knowledge essential to the practice of surgery.

We recommend the student to gain a perfect knowledge of the Bones; and then, in prosecuting dissection, to pursue the order laid down in this work. At the same time he must bear in mind, that, in some instances, the descriptions are more minute than the importance of the subject demands, from the Author's wish to make the work more complete for reference; but with the general directions already given, we presume, that the details will not abstract the attention from the leading points.

We should also advise the student to provide himself with some preparations, for the purpose of keeping up his anatomical knowledge. They should consist, at least, of a set of separate bones; and, if possible, of a skeleton; of an upper and a lower extremity, and of a head and neck, in the adult, injected to show the blood-vessels; side-views of the male and female pelvis wet,—to show, besides the relative position of the contents of the pelvis, the parts of inguinal and crural hernia. To these may be added a small subject, to show the distribution of the nerves, and preparations of particular parts, as of the lachrymal sack and duct, &c. These consulted as occasion may require, with the help of a work of anatomical reference, may keep up a competent knowledge of anatomy.

These, then, are the uses of anatomical knowledge as acquired by dissection. In whatever age or country the knowledge of Anatomy has been absent, medical science has existed in one or other of two extremes: it has either groped in detail with a blind empiricism, or blundered by wholesale with a dreaming and presumptuous arrogance; in the one case, sinking below experience—in the other, soaring above it, into the empty regions of abstraction. That *we* are enabled to take the middle path, we owe to the courage and industry of the great anatomists before us, more than to any other single cause. But there is one use to be derived from the study as at present pursued, which is negative indeed, but of scarcely less importance to the students as men, than the other and positive uses are to them as medical practitioners. By serious reflection on what Anatomy has not taught us, and what no Anatomy ever can teach us, the great laws of life, we learn not to overvalue the senses so as to forget the higher faculties of our nature, at the very time that we are most sensible that it is only by combining these with the exercise of the senses, that we can exert ourselves to any purposes of utility or of duty in that world of the senses which is the appointed sphere of both.

THE

DISSECTOR'S MANUAL.

SECTION I.

OSTEOLOGY.

CHAPTER I.

Of the Skeleton.

The Bones are those hard parts of the Human body composed principally of phosphate with a small portion of carbonate of lime deposited in an organized substance, consisting of gelatine, which is plentifully supplied with vessels, for the purpose of nourishment and growth.

They serve to give support and form to the soft parts, to protect the more important organs, and to afford a series of levers, by means of which, through the agency of the muscles, locomotion is performed.

The bones taken together form

THE SKELETON,

which is said to be either NATURAL or ARTIFICIAL.

It is called a NATURAL SKELETON, when the bones are kept together by their natural ligaments; but this kind is of little use for practical purposes, as the extremities of the bones, which are very important, are so completely covered, that their form cannot be seen. It therefore becomes necessary to remove all the soft parts, and join the bones together with wires, and thus is produced the ARTIFICIAL SKELETON.

The Skeleton consists of two hundred and forty-one bones, which are divided into those of the Trunk, Extremities, and Head, some of them are single and others in pairs. They are

Of the Trunk 54.	Vertebræ	24
	Costæ	24
	Sternum	2
	Ossa innominata	2
	Os sacrum	1
	Os coccygis	1
Of the Extremities 132.	Claviculæ	2
	Scapulæ	2
	Ossa humeri	2
	Ulnæ	2
	Radii	2
	Ossa carpi	16
	—— metacarpi	10
	Phalanges digitorum manus	28
	Ossa sesamoidea	4
	Ossa femoris	2
	Patellæ	2
	Tibiæ	2
	Fibulæ	2
	Ossa tarsi	14
	—— metatarsi	10
	Phalanges digitorum pedis	28
	Ossa sesamoidea	4
Of the Head 55.	Os frontis	1
	Ossa parietalia	2
	Os occipitis	1
	Ossa temporum	2
	Os sphenoides	1
	Os ethmoides	1
	Ossa malarum	2
	—— maxillaria superiora	2
	—— nasi	2
	—— lachrymalia	2
	—— palatina	2
	—— turbinata	2
	Vomer	1
	Os maxillare inferius	1
	Teeth	32
	Os hyoides	1
		241

Before proceeding with the description of the Bones, it will be necessary to speak of

THE TERMS

generally used in describing *relative position*, or the relation which one part bears to another.

The anatomist supposes the body erect, with the arms in such a position that the palms of the hands are turned forwards, and the lower extremities so placed, that the knees and toes shall be directly in front. The terms, by which relative position is usually denoted, with their several senses, are as follows. By *superior* and *inferior*, we signify higher and lower with respect to *the summit of the head;* by *anterior* and *posterior*, we denote the situation of the parts as nearer to the fore or the hinder surface of the body; and by *laterally* to the *right* or *left*, we understand that the parts so described approach the one side or the other. *Inner* and *outer* express the relation of any given part or portion of the body to an imaginary plane, assumed by anatomists for the purpose of distinct conception or description, and named by them the *Median* plane, it being supposed to bisect the body into lateral halves, passing through the middle of the head and trunk, and continued between the inferior extremities: *inner* denotes an approach to, *outer* a removal from this imaginary plane. The terms *external* and *internal*, *without* and *within*, are used only in speaking of cavities.

CHAPTER II.

Of the Bones of the Trunk.

The Trunk is composed of the Spine, Thorax and Pelvis.

1. THE SPINE, *Columna Spinalis,*

Consists of twenty-four bones called vertebræ, which are piled one upon the other, the lowest resting upon the sacrum, and the uppermost supporting the head.

THE VERTEBRÆ.

Each vertebra consists of a body, seven processes, a hole, and four notches. The body, *corpus,* is the thick strong part situated in the front, of an irregular oval or rounded form; flat or slightly concave above and below, convex laterally before, and hollowed behind where it forms part of the spinal hole, *foramen vertebrale.* The processes are, four articular, *p. articulares;* two transverse, *p. transversi;* and one spinous process, *p. spinosus.*

Of the articular processes, which join the back part of the body and form the sides of the spinal hole, the two *superior* have their articulating surfaces facing backwards, and a little outwards, whilst the two *inferior,* face forwards, and rather inwards. From the roots of the superior articular processes extend outwards, or outwards and backwards, the transverse processes very strong and thick, which are particularly for the attachment of muscles. From between the superior and inferior articular processes extends backwards, or backwards and downwards, the spinous process, this is sharp above, concave below, and more or less hooked downwards.

By the junction of the processes with the back part of the body of the vertebra, the spinal hole is formed, which is either triangular or round, and through it passes the spinal marrow and its membranes. The roots of the articular processes are hollowed out above and below into notches, of which the inferior are very deep; these when the vertebræ are fitted

together form holes on each side, through which the nerves pass from the spinal canal.

DIVISION OF THE VERTEBRÆ.

The vertebræ are divided into three classes, the CERVICAL, of which there are seven, forming the neck; the DORSAL, or those of the back, which are twelve in number; and the LUMBAR, or those of the loins, consisting of five vertebræ. These three classes have remarkable general peculiarities, but they also differ from each other.

THE CERVICAL VERTEBRÆ are smaller than the others, their bodies are longer from side to side; the upper surface the largest, and concave laterally, the lower the smallest, and concave from behind forwards; articular processes oblique, the superior oval, slightly convex, facing upwards and backwards; the inferior also oval, slightly concave, facing downwards and forwards; transverse processes short and thin, passing directly outwards from the body, and from the roots of the articular processes, having a hole in each for the transmission of the vertebral artery, and bifurcated for the attachment of muscles; spinous process short, horizontal and bifid: spinal hole large and triangular; its upper edge sharp, its lower edge larger than the upper, and slightly rounded: the notches at the roots of the articular processes not so large as in the other vertebræ.

THE DORSAL VERTEBRÆ diminish in size from the first to the fourth or fifth, from which they increase to the twelfth, which is the largest of all: the body is longer from before to behind, than from side to side, flat above and below, and the inferior surface the largest; at the junction of the body with the arch, a half articular surface on the upper and lower margin, these when the vertebræ are put together form an articular surface on each side, between every two dorsal vertebræ to receive the heads of the ribs: articular processes perpendicular and flat, the two superior facing backwards and outwards, the two inferior forwards and inwards: transverse processes strong, extending outwards and backwards, having a concave articular surface on the front of their points for the tubercles of the ribs: spinous process much hooked downwards, triangular, and sharp above and behind, hollowed before and below: spinal hole round, notches larger than in the cervical vertebræ.

THE LUMBAR VERTEBRÆ are of larger size than the others, broader than their depth; their long axes from side to side, and slightly concave from behind to before, both above and below: articular processes perpendicular, the two upper concave, facing backwards and inwards, the two lower convex, facing forwards and outwards: transverse processes slender, and passing backwards and outwards, inclining at the same time rather upwards: spinous process deep, long, horizontal, and flattened at the sides: spinal hole triangular: notches large.

DIFFERENCES IN PARTICULAR VERTEBRÆ OF EACH DIVISION.

Among the CERVICAL VERTEBRÆ, the first, second and seventh differ from the others.

The *first vertebra or Atlas*, scarcely resembles a vertebra, consisting merely of a bony ring, the anterior part of which is hollowed out in place of the body, for the dentiform process of the second vertebra, and has an articular surface on its posterior surface for the front of that process; the superior articular processes irregularly oval, their long axes from behind to before concave in the same direction, and facing upwards and inwards; the inferior broad, and nearly flat, facing downwards and inwards: transverse processes not bifid but large, and originating from between the upper and lower articular processes, inclining slightly downwards; a groove extending on each side from the back of the hole in the transverse process, along the upper edges of the arch, and winding round the back of the roots of the upper articular processes for the vertebral artery to make its turn: spinal hole large: notches situated behind the roots of the articular processes.

The second vertebra, vertebra dentata vel axis, is remarkable for a strong toothlike process or pivot, the dentiform process, *p. dentatus*, which rises from the upper part of the body, has an oval articular surface on its front, and is received into the hollow of the Atlas: the superior articular processes very broad and nearly flat, face upwards and outwards, and are situated immediately to the outside of the dentiform process; the inferior placed below and behind them, face forwards and downwards: the transverse processes very small and single, originate from the outsides of the superior articular processes; the holes in them not perpendicular, but passing upwards and outwards: the spinal hole large: the superior notches behind the upper articular, the inferior before the lower articular processes.

The *seventh vertebra* differs from the other cervical, in being larger, in having the transverse processes single, with a hole in each for the transmission of the vertebral veins, and

† The tenth has only a pair of half articular surfaces for the tenth pair of ribs.

a smooth surface on the front of ~~their~~ its roots, over which the vertebral artery passes to enter into the holes in the transverse processes of the sixth; and the spinous process not bifid but longer and slightly hooked downwards like the dorsal.

Among the DORSAL VERTEBRÆ, the first, tenth, eleventh and twelfth differ from the others.

The *first* has a whole articular surface on each side of the body for the heads of the first pair of ribs, besides the half surfaces for the second pair.

x The ~~tenth~~, *eleventh and twelfth* have whole articular surfaces for the two ~~three~~ lowest pairs of ribs; the transverse processes diminish gradually in size, so that those of the twelfth are the smallest, and those processes of the eleventh and twelfth have no articular surfaces upon them: the *twelfth* is further distinguished by having its inferior articular processes convex laterally and facing forwards and outwards.

Among the LUMBAR VERTEBRÆ, the *fifth* differs in having the lower surface oblique instead of flat, so that the anterior edge of the body is much deeper than the posterior; and the spinous process is much hooked downwards.

GENERAL REMARKS ON THE SPINE.

The vertebræ when articulated together form the Spine or Vertebral Column, which measures about one-third of the total height of the body, the other two-thirds being made up of the head, pelvis and lower extremities. And with regard to the proportions which the different divisions of the Spine bear to each other, the dorsal division will be found ~~to be~~ about two inches shorter than the cervical and lumbar divisions taken together. When viewed in front, the Spine appears of a pyramidal figure, the base of it resting upon the sacrum, and the apex supporting the head: but the apex is not the most tapering part; the bodies of the vertebræ gradually diminish in size from the last lumbar up to the fourth or fifth dorsal, and from that they begin to enlarge up to the last cervical, from which again they diminish to the second cervical, which is very large in comparison with the four vertebræ immediately below it; and above that, the transverse processes of the first vertebra are seen much expanded beyond those of the other cervical vertebræ. With respect to the diminution of size in the middle of the dorsal vertebræ, it is probably intended to give room for the important viscera contained in the Thorax, of which they form a large part of the posterior boundary; and to this end some anatomists have described a curve to the left side to give room for the aorta. M. Beclard, however, has shown, that this circumstance merely depends upon the use of the right arm; for in persons who were left-handed, he found the curvature in the opposite direction. In looking at the Spine posteriorly, the spinous processes are seen projecting in the middle; those of the cervical and lumbar vertebræ horizontally backwards, and those of the dorsal hooked downwards; on each side of these is seen a groove, formed by the junction of the arches of all the vertebræ, and bounded on the outside by the transverse processes, in which lie nearly all the muscles contained in the vertebral region. These being prominent in the recent state, leave a depression between them, in which the points of the spinous processes are felt extending from the head to the sacrum.

A lateral view of the Spinal Column presents anteriorly, two convexities and a middle concavity, the superior convexity formed by the lower cervical and upper dorsal vertebræ, and the inferior by the lumbar; whilst the middle concavity is produced by the retrocession of the bodies of the middle dorsal vertebræ. Behind the bodies of the vertebræ, and between them and the roots of the articular processes, are seen the holes formed by the junction of the notches, through which the nerves pass from the spinal canal. And the different directions of the spinous processes may also be well seen in this view.

The spinal canal, *canalis vertebralis*, is formed by the junction of the arches of all the vertebræ, it is situated behind their bodies, and bounded by the roots of all the processes laterally and posteriorly: it forms a complete bony case for the spinal marrow, protecting it in its passage from the cranium to its termination in the sacrum: it is largest in the cervical and lumbar vertebræ, and smallest in the dorsal.

The *muscles* attached to the spine are, on the *back part* M. trapezii, latissimi dorsi, rhomboidei majores & minores, levatores scapulæ, serrati postici superiores, & inferiores, splenii, complexi, sacro lumbales, cervicales descendentes, trachelo mastoidei, longissimi dorsi, transversales colli, spinales & semispinales dorsi, semispinales colli, recti capitis postici majores & minores, obliqui capitis superiores & inferiores, multifidi spinæ, interspinales, intertransversales, & levatores costarum; on the *fore part* M. longi colli, recti capitis interni majores & minores, recti capitis laterales, scaleni antici, medii & postici; diaphragma, quadrati lumborum, psoæ magni & parvi, obliqui interni & transversales abdominis.

2. THE CHEST, *Thorax*,

Is formed by twelve pairs of RIBS, two bones of the STERNUM, and the twelve DORSAL VERTEBRÆ already described.

THE RIBS, *Costæ.*

Situation. Are placed on each side of the dorsal vertebræ, and form with them the posterior and lateral parts of the Thorax. They are divided into true, false, and floating ribs; of these the *true*, the seven superior, are articulated to the sternum; whilst the *false*, the three below the true, join by their cartilages to each other; and the *floating* ribs, or two lowest, have their anterior extremities terminating in the muscles and unattached to each other.

Description. The form of the ribs is very irregular. Each rib consists of two extremities with an intermediate body, which is more or less curved forwards and inwards, flat within and without, rounded above and sharp below, with a groove along its inferior edge for the intercostal vessels and nerves: the posterior or vertebral extremity is called the *head*, which has two *articular surfaces* upon it divided by a middle ridge, to articulate with the bodies of the dorsal vertebræ; immediately to the outside of the head, the bone is contracted to form the *neck*, which is marked by the capsular ligament; a little to the outer, under, and back part of the neck is the *tubercle*, having a plane *articular surface* for the transverse process of the vertebra; further outward the bone becomes suddenly bent forwards and produces the *angle;* from which proceeds the *body*, which passes forwards and inwards, inclining at the same time downwards, to terminate at the *sternal extremity*, which becomes deeper and has an oval concave surface, in which the cartilage is received.

DIFFERENCES IN PARTICULAR RIBS.

No two pairs of ribs resemble each other in length or in the direction of their curvature; the first pair are the shortest, the second longer than them, and so on till the seventh pair; when they begin again to decrease in length to the twelfth, which are nearly as short as the first pair: and with regard to the direction of their curvature, that of the first is nearly horizontal, whilst the lower pairs dip down more and more at their points. But there are other more remarkable distinctions in the first, eleventh and twelfth ribs.

The *first rib* is very short and much curved, its body is very thin, and broad above and below, with a smooth and slightly hollowed surface near its sternal extremity, over which the subclavian artery passes; its head has only a single articular surface, by which it joins to the whole articular surface on the side of the body of the first dorsal vertebra; and the tubercle, which is very large, is placed immediately upon the angle of the bone, so that some anatomists describe it as wanting the angle.

The *eleventh and twelfth* ribs are shorter than all the others, except the first: their heads have only single articular surfaces to join with the whole articular cavities on the sides of the lowest dorsal vertebræ, and they have no angles: their anterior extremities, although tipped with cartilage, are not attached to the cartilages of the other ribs, but are floating amongst the muscles, from whence they have been called *floating ribs;* and not having tubercles they are not connected with the transverse processes of the vertebræ.

The *muscles* attached to the ribs are the pectorales majores & minores, subclavii, sterno thyroidei, scaleni antici, medii, & postici, latissimi dorsi, serrati majores antici, superiores & inferiores postici, sacro lumbales, accessorii ad sacro lumbalem, longissimi dorsi, levatores & depressores costarum, intercostales, sterno costalis, diaphragma, obliqui externi & interni, transversales & recti abdominis, & quadrati lumborum.

THE BREAST-BONE, *Sternum.*

Situation. In the front of the chest and connected with the ribs and clavicles. It consists of two bones.

Description. The *first bone* is of a triangular shape, the base of which is above, very thick, and forms the fore and upper boundary of the chest; the apex below and truncated, having an irregular articular surface for the second bone: it is irregularly convex before and concave behind: at the top on each point is an articular surface, concave from side to side for the sternal extremities of the clavicles, and between them the top of the bone is rounded: on each side and below these, is a large whole articular surface for the cartilage of the first rib: the sides of the bone become contracted, and at the lower part is a half articular surface for the second rib.

The *second bone* is long and narrow, flat before and behind: at the top it has an articular surface for the first bone, and below, a smaller one for the ensiform cartilage, which has a half articular surface for the seventh rib, and in old people is converted into bone: on either side it has four whole concave articular surfaces for the third, fourth, fifth and sixth ribs, and two half ones for the second and seventh, that at the upper part being for the second, and that at the lower for the seventh, which is not very distinct from the whole one for the sixth rib.

The *muscles* attached to the sternum are the M. pectorales majores, sterno mastoidei, sterno hyoidei, sterno thyroidei, sterno costalis, intercostales interni.

General View of the Thorax.

The Thorax, composed of the dorsal vertebræ, sternum and ribs with their cartilages, resembles a cone, the base of which is below and the apex above: the base is very wide, particularly in a transverse direction, and is remarkable for a deep notch which is bounded laterally by the margins of the cartilages of the ribs, and has projecting into it from above the point of the ensiform cartilage: the apex is truncated, leaving an oval opening, which is longest from side to side, through which pass the trachea, the œsophagus, the great vessels of the upper extremities and head, and the nerves of the thoracic and abdominal viscera.

As to the relative proportions of the thorax in the male and female, in the former it is highest, and in the latter widest.

3. THE PELVIS

Is the large bony cavity situated at, and forming the lowest part of the trunk, by means of which its weight is transmitted to the lower extremities. It consists of a pair and two single bones, the OSSA INNOMINATA, OS SACRUM, and OS COCCYGIS.

UNNAMED BONES, *Ossa Innominata.*

A pair.

Situation. On the sides and front of the Pelvis. Each Os Innominatum is usually described as consisting of three portions, viz. OS ILII, OS ISCHII and OS PUBIS. Into which it is found divided in the young subject: but at the age of puberty or soon after, the three pieces become united and form one bone.

a. Hip-bone, *Os Ilii.*

Situation. At the upper and outer part of the pelvis and forming the projection called the Hip.

Description. The lower part of the bone forming the upper part of the *acetabulum* or articular cavity for the head of the thigh bone, has above it a smooth surface, over which the M. psoas magnus & iliacus pass from the abdomen: bounding this to the outer side, and above, is the inferior anterior spinous process, *p. spinosus inferior anterior,* to which one head of the M. rectus femoris is attached, above which is a notch bounded superiorly by the superior anterior spinous process, *p. spinosus superior anterior,* to which the M. tensor vaginæ femoris & sartorius are attached: extending backwards and

upwards and then backwards and downwards is the crest, *crista*, which has an inner and outer lip, *labium internum & externum*, to which the M. obliquus externus & internus & transversalis abdominis, quadratus lumborum & latissimus dorsi are attached: the crest is terminated by the superior posterior spinous process, *p. spinosus superior posterior:* below which is a small notch bounded inferiorly by the inferior posterior spinous process, *p. spinosus inferior posterior:* and from between the two processes originates the M. sacrolumbalis & longissimus dorsi: before this the bone appears cut out to form part of the greater ischiadic notch, *incisura ischiadica major*, and from thence begins the Ischium: on the inside of the posterior spinous processes, is a large irregular articular surface for the sacrum, which with it forms the sacro iliac symphysis, or bird's head articulation. The ilium is of an irregular fanlike shape, the handle of which is forming the upper part of the acetabulum; it is irregularly convex without, and this part is called the back, *dorsum*, which is marked by a curved line extending in a curved direction from the superior anterior spinous process to the middle of the ischiadic notch, below t
which the M. gluteus minimus arises, and above it the M. gluteus medius: the inside is called the belly, *venter*, it is concave and smooth, giving origin to the M. iliacus; from the middle of the articular surface for the sacrum, there is an obtuse edge extending forwards to the junction of the bone with the os pubis, as if the bone were pinched up, it forms part of the brim of the pelvis, *linea ilio pectinea*, into which the M. psoas parvus is inserted.

β. THE HAUNCH-BONE. *Os Ischii.*

Situation. At the outer and under part of the pelvis, and forming the back and under part of the acetabulum.

Description. Continuous from that part of the ischiadic t
notch, at which the ilium terminates, is the Ischium, which forms the front of the greater notch, and the lowest boundary of the notch is marked by a blunt spinous process, *p. spinosus*, giving origin to the superior head of the M. gemini & coccygeus and the anterior sacro ischiadic ligament, opposite to which the bone is very thick, forming the back and under part of the acetabulum: below the spinous process is another notch, the lesser ischiadic notch, *incisura ischiadica minor*, bounded below by the broad tuberosity, *tuber*, which has an irregular surface upon it, broadest behind and covered with cartilage, upon which we sit, and giving origin to the abductor and adductor muscles of the thigh and the flexors of the leg: on the inside of the tuberosity is a groove in which the pudic artery and vein lay: above the tuberosity, between it and the under part

of the acetabulum, is a groove, over which the tendon of the M. obturator externus plays: extending forwards and upwards is the leg, *crus*, obtuse within, where it gives attachment to the crus penis & M. erector penis; and sharp without, where it forms part of the *foramen obturator*, and about the middle of this, on its inner side, it terminates in the crus of the os pubis.

γ. THE SHARE-BONE. *Os Pubis.*

Situation. In the front of the pelvis and forming the inner and under part of the acetabulum.

Description. Continuing upwards, from the crus of the ischium, is the leg, *crus*, of the Pubis, the outer edge of which forms part of the obturator foramen, and the inner rough to form the *symphysis* or junction of the two ossa innominata: at right angles with the crus and extending outwards is the angle, *angulus*, immediately before which is the spinous process, *p. spinosus*, to which Poupart's ligament is attached; extending outwards is the body, *corpus*, smooth above, forming the flat surface over which the iliac vessels and the anterior crural nerve pass; sharp below to form the upper part of the obturator foramen, and sharp behind to complete the linea iliopectinea: at the outer extremity, the body becomes thick and hollowed to form the fore and under part of the acetabulum.

The articular cavity for the head of the thigh bone, *acetabulum*, is formed by the junction of the ilium, ischium, and pubes: it is of a deep cuplike shape, with its concavity facing outwards and a little downwards: its margin is not completely circular, but deficient at the under and fore part forming a notch, which space in the recent state is filled up with ligament; the upper, outer and under part of the acetabulum is smooth, but opposite the notch it is scooped out, forming a cavity to which the round ligament is attached, surrounded by a quantity of fat: the upper and outer part of the acetabulum, by which the weight of the body is transmitted to the head of the thigh bone, is the deepest, and the under and fore part the shallowest. The proportions in which the ilium, ischium and pubis enter into the composition of the acetabulum are the upper and outer part not quite two-fifths of the whole cavity by the ilium, the under part rather more than two-fifths by the ischium, and the fore part one-fifth by the pubis.

The obturator hole, *foramen obturator*, is formed by the ischium and pubis, it is of an oval shape, its long axis upwards, and has a sharp edge, to which a ligament is attached.

The *muscles* attached to and covering the os innominatum,

~~pectineus~~ . ~~& externus~~

are the M. psoas magnus & parvus, iliacus, levator ani, obturator internus, pyriformis, coccygeus, obliquus externus & internus, transversalis, rectus & pyramidalis abdominis, quadratus lumborum, longissimus dorsi, sacro-lumbalis & latissimus dorsi, tensor vaginæ femoris, sartorius, gluteus maximus, medius & minimus, rectus femoris, gemini, quadratus femoris, biceps flexor cruris, semitendinosus & semimembranosus, transversus perinæi, & transversus perinæi alter, erector penis vel clitoridis, triceps adductor femoris, gracilis, pectineus & obturator externus.

THE RUMP-BONE. *Os Sacrum.*

Situation. In the back of the pelvis, supported by the ossa innominata on the sides, and receiving the Vertebral Column above.

Description. The Sacrum is of a triangular shape, its base facing upwards and forwards, its apex which is truncated also facing forwards: it is concave before from above downwards, and irregularly convex behind in the same direction: in the young subject it consists of five pieces, which from their general resemblance to the vertebræ, have been called the false vertebræ, but in the adult they are anchylosed into a single piece: in the anterior concave surface are four transverse lines marking the original separation into the five bodies, and on each side of these are the four anterior sacral holes, *foramina sacralia anteriora,* bounded by the transverse processes, *p. transversi;* the upper transverse processes very broad, and having a notch between them and the articular surface on the base, to form part of the holes for the last pair of lumbar nerves: on the base or upper part, an oval articular surface, its long axis from side to side, and facing upwards and forwards for the body of the last lumbar vertebra: the apex or lowest part having an oval articular surface for the os coccygis, and a notch on each side of it for the last pair of sacral nerves: on the posterior surface in the middle are four processes answering to the spinous processes of the vertebræ, which are generally bifid, and occasionally so completely as to leave the spinal canal open, and this is generally the case with the two lowest: on either side of these are four holes, *foramina sacralia posteriora,* for the passage of small branches of nerves and vessels: the sides of the sacrum are of an irregular triangular shape with the base above, and having an articular surface for the os innominatum. In consequence of the base of the sacrum facing forwards and upwards, the anterior margin projects considerably, and this is called the *promontory* of the sacrum.

× Latissimi Dorsi

The *muscles* attached to the sacrum are the M. longissimi dorsi, sacro-lumbales, multifidi spinæ, glutei maximi pyriformes & coccygei.

The Coccyx. *Os Coccygis.*

Situation. At the tip of the os sacrum.

Description. The Coccyx consists of three or four pieces, in shape resembling the sacrum, and movable upon it, and one another, till late in life, when they become anchylosed into a single bone: the upper is the largest, and the lower the smallest piece; they have plain oval concave articular surfaces above and below for each other; the upper surface of the first piece is the largest, and receives upon it the point of the sacrum: behind and to the outer sides of this surface are two little horns, *cornua,* giving attachment to ligaments: the lowest point of the last piece is rounded: the lateral edges answering to transverse processes are thin and sharp: neither piece is perforated by the spinal canal.

The *muscles* attached to it are the M. coccygei.

General View of the Pelvis.

The Pelvis, composed of the ossa innominata, os sacrum and os coccygis, is divided into two cavities by the linea ilio pectinea, which extends from the front on either side as far as the sacro iliac symphysis, sharp before and obtuse behind.

The upper cavity or *false pelvis* only partial, being deficient in front; its lateral and posterior parts are formed by the venter of the ilia, and the fore part is completed by the abdominal muscles, against which the abdominal viscera rest.

The lower cavity, or *true pelvis,* is bounded anteriorly by the ossa pubis and ischii, laterally by the ossa ischii, and a small portion of the ossa ilii, and posteriorly by the os sacrum and os coccygis. It contains in the male the bladder and rectum; and in the female besides them, the vagina and uterus.

The upper opening is called the brim, *facies abdominalis:* its figure resembles the shape of the heart painted on cards, the point of which is placed in front. The diameter of the brim differs much in the male and female pelvis, in the former it is greater from pubis to sacrum, in the latter from ilium to ilium.

The lower opening is named the *outlet,* it is of an irregular diamond shape, and having the points before, behind and on the sides: in the male it is comparatively small, but in the female very large, and within the latter the greatest extent is from pubis to sacrum, on account of the sacrum not being so much curved as in the male.

The *cavity*, or *true pelvis*, is placed between the brim and the outlet; it is deepest posteriorly, not so deep laterally, and shallowest anteriorly.

Forming the front of the true pelvis are the pubes, the junction of the rami of which at the symphysis produces the *arch of the pubis;* this in the male is very acute, but in the female it is obtuse for the purpose of increasing the size of the outlet to facilitate delivery. On each side of the arch of the pubis is found a large hole, the obturator hole, *foramen obturator*, the margin of which is very sharp for the attachment of ligaments, except at the upper and outer part where it is rounded for the passage of the obturator artery, vein, and nerve.

Still further outwards are found the *acetabula* or articular cavities for the heads of the thigh bones, which have been before described.

With respect to the axis of the pelvis, it is so placed, that the trunk does not rest upon the outlet, but upon the tuberosities of the ischia, so that the outlet faces downwards and backwards, and the brim upwards and forwards, in such way, that a line raised perpendicular with the middle of the brim, will pass upwards and forwards through the umbilicus. This oblique bearing of the pelvis is particularly important in surgical and obstetric practice connected with the pelvis.

The differences between the male and female pelvis, may briefly be said to consist in the greater lateral diameter of the brim, in the greater extent of the outlet, in the greater width of the arch of the pubis, and the greater distance between the acetabula in the female than in the male.

CHAPTER III.

Of the Upper Extremity.

THE upper extremity consists of the SHOULDER, UPPER ARM, FORE ARM and HAND, these are connected by the clavicle to the trunk, and that is the only bony union; the other connections being by muscles.

1. THE SHOULDER, *Scapula*,

Consists of the CLAVICLE and SCAPULA.

THE CLAVICLE. *Clavicula.*

Situation. At the upper part of the chest, horizontally between the sternum and the scapula.

Description. The clavicle, so called from its resemblance to an ancient key, is divided into body, two extremities, two articular surfaces, and two processes; its shape is that of an italic *S*, and it is placed horizontally; its inner or *sternal extremity* is very large, and irregularly cylindrical; upon its point is a large articular surface, by which it joins with the interarticular cartilage placed between it and the sternum; about an inch from the sternal extremity on the under edge is a rough surface, the rhomboid process, *p. rhomboides*, by which it is attached to a ligament; it then becomes smooth and rounded, projects forwards, and afterwards backwards, having the hole for the medullary artery on its under surface, and about three-fourths from the sternal extremity projects forward again, becomes considerably expanded, and forms the *scapular extremity*, which is the flattest part of the bone; about an inch and a half from the outer point, and on its under surface, is a rough process called the tubercle, *tuber*, for the attachment of ligaments; and upon the outer part of the scapular extremity a plane articular surface for the acromion of the scapula.

Connection. With the first bone of the sternum by its inner, and with the acromial process of the scapula by its outer extremity.

The *muscles* attached to the clavicle are six, to its *under* part M. pectoralis major, deltoides, & subclavius; and to its *upper* part M. trapezius, sterno mastoideus, & sterno hyoideus.

THE BLADE BONE. *Scapula.*

Situation. On the posterior and superior part of the chest.

Description. The scapula is of a triangular figure consisting of three angles, three edges, three pits, three processes, two articular surfaces, and two notches; the inner and superior point is called the superior angle, *angulus superior,* the inner and inferior, the inferior angle, *angulus inferior,* and the outer and superior, the outer angle, *angulus externus;* the outer angle has a slightly concave oval articular surface upon it called the glenoid cavity, *cavitas glenoides,* by which the os humeri articulates with the scapula, and around it the bone is contracted and forms the neck, *cervix;* the edges, *costæ,* are the *inner* or base between the superior and inferior angles, the *inferior* between the inferior and external angles, and the *superior* between the external and internal angles: the body of the bone is divided behind or upon the *dorsum* into two pits, *fossæ,* of which the inferior is the larger by the spine, the space above it is called the *fossa supraspinata,* and that below it the *fossa infraspinata,* on the inferior point of this is a triangular flat surface immediately above the inferior angle, giving origin to the M. teres major; the front of the bone forming the third pit is hollow, and called the *fossa subscapularis* or *venter;* the spine, *spina,* begins from the base, where it has a small smooth surface about an inch and a half below the superior internal angle, it passes outwards and upwards, and terminates in the acromion, *processus acromion,* which is expanded over the top of the glenoid cavity, and about an inch above it, forming the point of the shoulder; it is of a triangular figure, and has an articular surface on its inner and anterior edge to join it to the clavicle; the third process is the coracoid, *processus coracoides,* which originates by a thick root from the fore and upper part of the neck of the bone, and curves forwards and outwards before the glenoid cavity; the notches, *incisuræ,* are *one* in the superior edge at the root of the coracoid process, and to its inner side for the passage of the supra scapular artery, vein, and nerve; and *one* between the root of the glenoid cavity and the root of the acromion, through which the superior dorsal artery and vein pass to the fossa infra spinata.

Connection. By the articular surface on the acromion with the collar-bone.

The *muscles* attached to the scapula are sixteen, viz. to the spine *above,* M. trapezius, and *below,* M. deltoides; to the base M. levator scapulæ, rhomboideus minor & major, & serra-

and Two ([illegible])

tus magnus; to the notch in the superior costa, M. omo-hyoideus; to the fossæ, M. supra spinatus, infra spinatus & subscapularis; to the inferior costa, M. teres minor & triceps extensor cubiti (its long head;) to the inferior angle, M. teres major; and to the coracoid process, M. coraco-brachialis pectoralis minor & biceps flexor cubiti (its short head;) the latter also from the upper edge of the glenoid cavity (its long head.)

2. THE UPPER ARM, *Brachium*,

Consisting of a single bone.

THE BONE OF THE ARM. *Os Humeri.*

Situation. On the side of the chest, forming the upper arm; attached to the scapula above, and to the radius and ulna below.

Description. The os humeri, or upper arm, is divided into the head, *caput*, two tubercles, *tubercula*, body, *corpus*, two condyles, *condyli*, three articular surfaces, and two pits; the head, which is hemispherical, is placed at the upper and inner part of the bone, facing upwards, inwards, and rather backwards, it is smooth to articulate with the glenoid cavity of the scapula, and around its edge are the marks produced by the attachment of the capsular ligament; on the outer and fore part are seen the two tubercles, separated by a groove, *sulcus bicipitalis*, for the tendon of the long head of the M. biceps, the anterior or lesser tubercle, *tuberculum minus*, giving insertion to the M. subscapularis, the external or greater tubercle, *tuberculum majus*, giving insertion to the M. supraspinatus, infraspinatus and teres minor; immediately below the head and tubercles the bone is contracted, and forms the neck, *cervix*; the body appears as if the upper part were twisted outwards and the lower inwards; the hole for the medullary artery, *foramen medullare*, is about one-third of the bone downwards; extending from the fore part of the greater tubercle downwards is the outer edge of the bicipital groove, to which the M. pectoralis major is attached, and from the lesser tubercle the inner edge of the same groove, to which the M. latissimus dorsi and teres major are attached; one third down on the outside is a rough surface to which the M. deltoides and brachialis internus are attached; at the same distance from the head, and to the inner side of the bicipital groove another rough surface for the attachment of the M. coraco brachialis & brachialis externus, (one of the heads of the M. triceps;) from the middle of the bone on the outside extending downwards to the outer condyle, is a line giving origin to the M. supinator radii longus & extensor carpi radialis longior, and on the inside another line passing to the inner condyle; between these two lines the M. brachialis internus arises before, and the M. brachialis externus behind; the outer condyle, *condylus externus,* which is at the outer side of the lower end of the bone, projects but little, it gives origin to the M. anconeus, extensor carpi ulnaris, ext. communis digitorum, ext. carpi radialis brevior & supinator radii brevis; the inner condyle, *condylus internus,* at the inside of the lower end of the bone, projects very much inwards, it gives origin to the M. pronator radii teres, and all the long flexors of the hand and fingers, except the M. flexor digitorum profundus; the lowest part of the bone has two articular surfaces upon it, that on the outside convex from before to behind, and from side to side, for the head of the radius; and that on the inside convex from before to behind, and concave from side to side, for the sigmoid cavity of the ulna: between this articular surface and the inner condyle behind is a groove, *sulcus ulnaris,* for the ulnar nerve: above the articular surfaces before, is a pit for the coronoid process of the ulna, and behind another deeper for the olechranon of the ulna, around the condyles there are ligamentous marks.

Connection. With the scapula above, and with the radius & ulna below.

The *muscles* attached to the os humeri are twenty-four; viz. M. deltoides, supra spinatus, infra spinatus, teres minor, subscapularis, pectoralis major, latissimus dorsi & teres major, coraco brachialis, triceps extensor cubiti, brachialis internus, palmaris longus, flexor carpi radialis, f. carpi ulnaris, f. digitorum sublimis perforatus, f. longus pollicis, pronator radii teres, supinator radii longus & brevis, extensor carpi radialis longior & brevior, e. carpi ulnaris, e. digitorum communis, & anconeus.

3. THE FORE ARM, *Antibrachium,*

Consists of two bones, the ULNA and RADIUS.

THE CUBIT. *Ulna.*

Situation. On the inside of the fore arm, attached above to the os humeri, on the outer side to the radius, and below by means of an interarticular cartilage to the os cuneiforme.

Description. The ulna is divided into a body, extemities, r/ four processes, and four articular surfaces; the upper extremity very large, scooped out anteriorly to form the greater sigmoid cavity, *cavitas sigmoidea major,* which faces for-

× and on the back is a slight groove for the m. e. carp: uln:.

× and four grooves

wards, and is divided by a middle ridge, for the inner articular surface of the base of the os humeri, and bounded before by a projecting lip called the coronoid process, *processus coronoides;* on the outer side, between the olechranon and the coronoid process, is a concave articular surface for the head of the radius, the lesser sigmoid cavity, *cavitas sigmoidea minor;* below, and before the coronoid process, is another process called the tubercle, *tuber;* the greater sigmoid cavity is bounded behind and above by the olechranon, *processus olechranon,* which forms the projecting part of the elbow, gives insertion to the M. triceps extensor cubiti behind, and to the M. anconeus on its outer edge; it has a flat surface on the posterior part covered only by skin, which is strictly the space called the elbow, or *ancon;* the body of the bone, *corpus,* is strongly marked by the attachment of muscles; it is rounded and smooth on the inner, and sharp on the outer side, for the attachment of the interosseous ligament; about a third down is the hole for the medullary artery; the lower end of the bone is rounded, having a rounded articular surface for the base of the radius, and an irregular one below for the interarticular cartilage; on the inside it is lengthened to form the styloid process, *processus styliformis,* X

Connection. With the humerus above; with the radius on the outside; and by the interarticular cartilage with the cuneiform bone below.

The *muscles* attached to the ulna are fourteen; viz. M. brachialis internus, triceps extensor cubiti & anconeus, pronator radii teres, flexor carpi radialis, f. carpi ulnaris, f. digitorum communis sublimis & profundus, pronator quadratus, extensor carpi ulnaris, e. ossis metacarpi pollicis, e. primi internodii poll., e. secundi internodii poll. & indicator.

THE SMALL BONE OF THE ARM. *Radius.*

Situation. On the outside of the fore arm, attached above to the os humeri, on the inner side to the ulna, and below to the os scaphoides and lunare.

Description. The radius is said to resemble the spoke of a wheel; it is divided into head, neck, body, base, two processes, ~~and~~ four articular surfaces X; the head or upper part, *caput,* is rounded, having a concave articular surface at the top to receive the convex articular surface of the outer condyle of the os humeri; on the side of the inner and anterior half of the head is an articular surface, by which it joins with the lesser sigmoid cavity of the ulna; immediately below this the bone is contracted to form its neck, *cervix,* bounded below on the fore and inner part by an obtuse process called the tubercle, *tuber,* into

which the tendon of the M. biceps flexor cubiti is inserted ; the body, *corpus*, is rounded along its outer edge, and sharp within, to give attachment to the interosseous ligament : the lower end of the bone is much expanded, forming the base, *basis*, which has a triangular concave articular surface, with its apex outwards for the scaphoid and lunar bones, sometimes divided by a ridge ; on the inside it has a concave articular surface for the lower extremity of the ulna ; on the outer edge it has a groove, through which pass the tendons of the M. extensor ossis metacarpi & e. primi internodii pollicis, and on the back three other grooves, the largest of which is the outermost for the tendons of the M. ~~e. secundi internodii pollicis &~~ that of th
e. carpi radialis longior, next to it is a small one for e. secu
~~that of the M. extens. carpi rad.~~ & brevior, and the innermost nearest the ulna gives passage for those of the M. indicator & extensor digitorum communis ~~& e. carpi ulnaris~~.

Connection. With the humerus above ; with the ulna on the inside ; and with the scaphoid and lunar bones below.

The *muscles* attached to the radius are eight ; viz. the M. supinator radii longus & brevis, pronator teres, & quadratus, biceps flexor cubiti, flexor digitorum communis sublimis, f. pollicis longus, extensor ossis metacarpi pollicis.

4. THE HAND, *Manus*,

Consists of the CARPUS, METACARPUS and PHALANGES ; of these, part of the carpus with the radius form the wrist joint ; the metacarpus forms the palm of the hand ; and the phalanges the fingers.

THE CARPAL BONES. *Carpus.*

Situation. Between the fore arm and hand.

Description. They consist of eight bones forming an arch, supported by ligament, the concavity of which is placed before and the convexity behind. These eight bones are arranged in two rows, four in each ; they are in the first row, the os scaphoides on the outside, on its inner side the os lunare, next it the os cuneiforme, and on the front of that bone the os pisiforme ; in the second row on the outside, is the os trapezium, next to it, the os trapezoides, to its inner side, the os magnum, and next to that, the os unciforme. Of these bones the first row is articulated above with the radius, and the interarticular cartilage at the extremity of the ulna, and below with the second row ; the second row articulates above with the first row, and below with the bases of the metacarpal bones.

X is extended to form the styloid process

li-determinate pollices

THE SCAPHOID BONE. *Os Scaphoides.*

Description. The scaphoid bone somewhat resembles a boat in shape; it has four articular surfaces; one above, the largest, is convex, and of a triangular shape, with its apex outwards for the base of the radius; one on the back and under part also convex, for the os trapezium and os trapezoides; one on the inner and upper part small and flat, for the lunar bone; and one below it and on the inside concave, to form part of the socket for the head of the os magnum: the rest of the bone not occupied by articular surfaces is strongly marked by ligament.

Connection. Above to the radius, below to the trapezium & trapezoid, on the inner side to the lunar, and below it to the large bone.

There are no *muscles* attached to this bone.

THE LUNAR BONE. *Os Lunave.*

Description. The lunar bone is said to resemble a half moon, its convexity being placed upwards; it is largest on its fore part and projects into the carpal arch; it has four articular surfaces; one above convex, for the radius; one below concave, which with that of the scaphoid bone, forms the cup for the head of the os magnum; one on the outside flat, for the scaphoid bone; and one on the inside, also flat, for the cuneiform bone.

Connection. With the radius above, and the large bone below, with the scaphoid on the outer, and the cuneiform on the inner side.

No *muscles* attached to this bone.

THE CUNEIFORM BONE. *Os Cuneiforme.*

Description. The cuneiform bone is said to resemble a wedge, the base of which faces outwards, and the apex inwards; it has four articular surfaces; a small one on its upper and outer edge, for the interarticular cartilage, which is attached to it; another on the outside, for the lunar bone; one below slightly and irregularly concave, for the unciform bone; and a flat one on its fore part, for the os pisiforme.

Connection. Above with the interarticular cartilage of the ulna, below with the unciform bone, on the outside with the lunar, and before with the pisiform bone.

No *muscles* attached to this bone.

THE PISIFORM BONE. *Os Pisiforme.*

Description. This bone is named from its resemblance to a large pea, it is rounded before and has a flat articular surface behind.

Connection. With the front of the cuneiform bone.

The *muscles* attached to it are ~~two~~; viz. the M. flexor carpi ulnaris & abductor minimi digiti & palmaris brevis

THE TRAPEZIUM. *Os Trapezium.*

Description. Said to resemble the mathematical figure of that name, but of an irregular form; it is remarkable for a deep groove on its fore part, through which the tendon of the M. flexor carpi radialis passes; it has four articular surfaces; one concave above, for the scaphoid bone; one on the inside, for the trapezoid bone; a large one on the outside, concave from above downwards, and convex from before to behind for the metacarpal bone of the thumb; and a small flat one below, for part of the metacarpal bone of the fore finger, between that for the metacarpal bone of the thumb and that for the trapezoid bone.

Connection. Above to the scaphoid, on the outside to the metacarpal bone of the thumb, on the inside to the trapezoid, and below to the metacarpal bone of the fore finger.

The *muscles* attached to it are four; viz. M. flexor ossis metacarpi pollicis, abductor pollicis, abductor indicis & extensor ossis metacarpi pollicis.

THE TRAPEZOID BONE. *Os Trapezoïdes.*

Description. The trapezoid bone, like the preceding, is also said to resemble the mathematical figure; it is, however, of a very irregular shape, being broadest and smoothest behind, with its lower edge rounded: it has four articular surfaces, one above, for the scaphoid; one on the outside, for the os trapezium; one on the inside, for the os magnum; and one below, for part of the metacarpal bone of the fore finger.

Connection. Above with the scaphoid, below with the metacarpal bone of the fore finger, on the outside with the os trapezium, and on the inside with the os magnum.

The only *muscle* attached to this bone is the M. flexor brevis pollicis.

THE LARGE BONE. *Os Magnum.*

Description. This is the largest bone of the carpus, from whence it derives its name; it has six articular surfaces, it is sometimes called *os capitatum,* on account of the head or large hemispherical articular surface at the upper part, which forms a ball to be received into a socket formed in the first row of the carpal bones by the scaphoid and lunar bones, which tends much to strengthen the junction of the parts of the carpus three

x outer

x ud=

to each other; on the outside, the large bone has an articular surface for the trapezoid, and on the inner, for the unciform bone; below, it has an irregularly concave surface for the metacarpal bone of the middle finger, the inner edge of which is pared off as it were to articulate it with a small portion of the metacarpal bone of the fore finger; and a similar but much smaller articular surface is found on the posterior and inner point, for the metacarpal bone of the ring finger.

Connection. Above with the scaphoid and lunar, on the outside with the trapezoid, and on the inner side with the unciform bone, below in the middle with the metacarpal bone of the middle, on the outside with that of the fore, and on the inside with that of the ring finger.

The only *muscle* attached to this bone is the M. flexor brevis pollicis.

THE UNCIFORM BONE. *Os Unciforme.*

Description. The unciform bone has a remarkable hook-like process on its fore and inner edge which curves outwards towards the root of the thumb; it has four articular surfaces; one large above and to the inner side, for the cuneiform; one on the outside, for the os magnum; and two below divided by a ridge, the outer smaller one for part of the metacarpal bone of the ring finger, and the other for the metacarpal bone of the little finger.

Connection. Above with the cuneiform, on the outside with the large bone, and below with the metacarpal bones of the ring and little fingers.

The *muscles* attached to this bone are three; viz. the M. flexor brevis pollicis, f. proprius, & [illegible]ductor minimi digiti.

THE METACARPAL BONES. *Ossa Metacarpi.*

Situation. Below the carpus and above the fingers, forming the back and palm of the hand.

Description. Of the metacarpal bones there are five, each of which is divided into its upper part, or *basis*; middle or body, *corpus*; and lower part or head, *caput*, which forms the knuckle and projects when the fingers are bent; upon the bases are articular surfaces for the carpal bones; the bodies behind are sharp above and expanded below towards the knuckles, before they are expanded above and sharp below for the purpose of giving room for the M. interossei; the heads of all, except that of the thumb, are convex from before to behind and from side to side, having large articular surfaces for the first row of the phalanges of the fingers; and immediately above the head is a groove for the attachment of the capsular ligament. They differ much from each other, particular that

Of the *Thumb*, which very much resembles the first phalanx of the fingers: it is the shortest of all the metacarpal bones, and placed obliquely on the carpus, instead of perpendicularly like the other metacarpal bones; above it is the same breadth throughout, smooth behind, rounded from side to side before, and forming a sharp edge on either side; the articular surface on its base is much expanded, it is convex laterally, and concave from before to behind, the anterior lip being much produced; its head is slightly convex from before to behind, but flat laterally.

Connection. With the trapezium above.

Of the *First Finger.* The basis of this bone has three articular surfaces divided by two edges, the middle and larger for the os trapezoides; the outer and smaller for the os trapezium; and the inner for the os magnum; immediately below the articular surface for the os magnum, is a plane surface on the side, for the metacarpal bone of the second finger.

Connection. With the trapezium, trapezoid, and large bone above, and with the metacarpal bone of the second finger on the inside.

Of the *Second Finger.* The basis of this bone has an articular surface in the middle for the os magnum; one on the outer side of the base, concave for the base of the metacarpal bone of the first finger, and another on the inside for that of the third finger.

Connection. With the os magnum above, with the metacarpal bone of the first finger on the outside, and of the third finger on the inside.

Of the *Third Finger.* The basis of this has two articular surfaces, a very small one at the upper and outer part for the os magnum, and a large one on the upper and inner part for the os unciforme; on each side of the base are articular surfaces for the metacarpal bones of the second and fourth fingers.

Connection. Above with the large and unciform bone; on the outside, with the metacarpal bone of the second, and on the inside with that of the fourth.

Of the *Fourth Finger.* The base has an articular surface for the os unciforme above, and on the outside another for the metacarpal bone of the third finger.

Connection. With the os unciforme above, and the metacarpal bone of the third finger on the outside.

The *muscles* attached to the metacarpal bones are fifteen; viz. M. interossei, (seven) common to all except that of the thumb;

to that of the thumb *before*, M. flexor brevis & flexor ossis metacarpi pollicis, & abductor indicis, & *behind*, extensor ossis metacarpi poll.; to that of the fore finger *before*, M. flexor carpi radialis, & *behind*, M. extensor carpi radialis longior; to that of the middle finger, M. extensor carpi radialis brevior, and to that of the little finger, M. extensor carpi ulnaris.

THE FINGERS. *Phalanges Digitorum.*

The thumb and fingers of each hand consist of fourteen pieces or phalanges, of these twelve belong to the fingers, and are disposed in three rows, those of the middle finger being longest, and of the little finger shortest; whilst the thumb has but two, its middle phalanx being deficient, but they are stronger than those of the fingers. The phalanges consist of base, body, and head, and they taper from the base or upper part to the head, the intermediate part or body being rounded behind and flat before, with two projecting lateral edges to give attachment to the sheaths of the tendons.

In the *First Row*, the base is concave from before to behind and from side to side, in which direction it is longest; the head has a pulley-like articulation upon it, concave laterally, broadest in front, and convex from before to behind.

In the *Second Row*, which is wanting in the thumb, the base is concave laterally, and deepened before and behind in the middle by a lip, between which a ridge extends, dividing it into two smaller concavities: the body and head are like those of the first row, but the body is shorter.

In the *Third Row*, the phalanges become very taper, their bases are like those of the second, but their points are expanded into thin rough surfaces, which are rounded at the tip and give attachment to the nails.

The *muscles* attached to the phalanges are twenty-one; viz. *before*, M. flexor brevis digitorum sublimis & profundus, flexor longus & brevis, & adductor & abductor pollicis, flexor proprius & adductor minimi digiti, lumbricales (four) & interossei (seven); *behind*, M. extensor digitorum communis & indicator.

SESAMOID BONES. *Ossa Sesamoidea.*

Of these there are usually two at the root of the first phalanx of the thumb; they are small bones, round before and flat behind; they give attachment to the M. flexor brevis pollicis manus; sometimes there are also some to the little finger.

CHAPTER IV.

Of the Lower Extremity.

THE lower extremity consists of the THIGH, LEG, and FOOT, which are connected by the head of the thigh bone with the acetabulum.

1. THE THIGH, *Femur*,

Consisting of a single bone.

THE THIGH BONE. *Os Femoris.*

Situation. In the thigh between the trunk above and the leg below.

Description. The os femoris is the largest bone in the body; it consists of a head, neck, and trochanters or upper part; a body or middle; and condyles, or lower part. The head, *caput*, is situated at the upper and inner part of the bone, forming the greater part of a sphere, and presenting a large articular surface which faces upwards and inwards, and has a rough hole in it to which is attached the round ligament; extending outwards and downwards to join with the upper part of the body is the neck, *cervix*, which is broader below than above, and flattest behind and before; a rough oblique line marks the extent of the neck and the attachment of the capsular ligament in front; the upper and outer part of the body projects above the neck, forming the greater trochanter, *trochanter major*, it is smooth on the outer and back part where the M. gluteus maximus passes over it; its upper part gives attachment to the M. gluteus medius & minimus, and has a deep pit on the inside to give insertion to some of the abductor muscles: about two inches below it, on the inner and back part of the bone, is a strong rounded projecting process, the lesser trochanter, *trochanter minor*, to which the M. psoas magnus and iliacus are attached; a curved line, *linea quadrata*, extending from one trochanter to the other, gives attachment to the M. quadratus femoris, and marks the termination of the neck and the attachment of the capsular ligament posteriorly: the body, *corpus*, is arched in front and slightly concave behind, it is smooth and slightly rounded before, but sharp in the middle behind, forming the rough line, *linea aspera*, which occupies the middle third of the bone, and divides above and below into two lines, the two upper pass one into each trochanter, and the two lower, one

crucial

into each condyle, having between them a flat triangular space, strictly called the Ham, in which the popliteal artery, vein, and nerve lay; the lower end of the bone becomes much expanded to form the condyles, *condyli*, of which the inner is considerably the larger and longer; upon the condyles are four articular surfaces, the *two upper* on the fore part for the patella, of which that on the outer condyle is the larger, and separated from each other by a slight depression, and the *two lower* for the head of the tibia, extending very far backwards and upwards, and separated by a very deep pit, into which the cruceal ligaments are inserted; these articular surfaces are broadest below and narrowest behind and above; on the inside of the inner condyle, and above its articular surface, is a projection more or less distinct, to which the M. adductor magnus femoris is attached. The medullary artery enters about the middle of the back of the bone.

Connection. By means of the head, with the acetabulum of the os innominatum above, and by the condyles, below, with the tibia, and before, with the patella.

The *muscles* attached to this bone are nineteen: viz. to the *trochanter major,* M. gluteus medius & minimus; to the *trochanter minor*, M. psoas magnus & iliacus; to the *linea quadrata*, M. quadratus; to the *fossa trochanterica*, M. obturator internus & externus, gemini & pyriformis; to the *linea aspera*, M. gluteus maximus, pectineus, & triceps femoris, vasti & biceps flexor cruris; to the *condyli*, M. gastrocnemius externus, plantaris & popliteus; to the *fore part* of the body, M. crureus: the M. sartorius, gracilis, & tensor vaginæ femoris, are upon the os femoris, but not attached to it.

2. THE LEG. *Crus.*

The leg is composed of three bones, the PATELLA, TIBIA, and FIBULA.

THE KNEE CAP. *Patella.*

Situation. On the front of the knee and protecting the joint: it may be considered to bear the same relation to the tibia, which the olechranon does to the ulna.

Description. The patella is of a heart shape, with the base, *basis*, above, and the point, *apex*, below, the sides, *margines*, are between the base and point; it is convex laterally and from above downwards, and rough in front in consequence of the attachment of the tendon of the M. rectus, and the ligament of the patella; it has two articular surfaces behind, slightly concave, and divided by a middle perpendicular projecting ridge, the outer of them being the larger.

Connection. With the condyles of the os femoris behind.

The *muscles* attached to the patella are four; viz. to the *basis*, M. rectus & crureus, and to the *sides*, M. vasti.

THE SHIN BONE. *Tibia.*

Situation. On the inside of the leg.

Description. The tibia is said to resemble an ancient flute in shape: it consists of a head or upper part, body or middle, base or lower part, ~~one~~ two processe and ~~five~~ articular surfaces; the head, *caput*, is much expanded, and is of an oval form, with its long axis from side to side; on the top it has two semicircular articular surfaces for the condyles of the ~~os~~ femoris, of which the inner is the larger; these are slightly concave, and have their diameters towards each other, separated by a middle ridge which has a pit before and behind it, to which the crucial ligaments are attached; on the posterior under and outer ~~inner~~ part of the head is a small flat articular surface for the head of the fibula; about an inch below the head on the fore part is the tubercle, *tuber*, which gives attachment to the ligaments of the patella and some muscles; the body, *corpus*, is of a prismatic form, the base of which is behind and the apex before, which latter presents a sharp ridge extending down to the inside of the base, and called *spina*, spine or shin: the inside of the body is very smooth and covered only by skin, the outside slightly hollowed for the lodgement of muscles, and the posterior irregularly flat and marked by an oblique line, *linea poplitea*, which extends from the articular surface for the fibula across to the inner edge of the bone, about a third downwards, and marks the attachment of the M. popliteus and gastrocnemius internus. The lower part of the bone is expanded to form the base, *basis*, which has an articular surface upon it, concave from before to behind for the top of the astragalus; on the inside the base is lengthened by a strong process, the inner ankle, *malleolus internus*, which is marked on the under back part by a slight groove for the passage of the tendon of the M. tibialis posticus, and has a flat articular surface on the outside for the inside of the astragalus; on the outside of the base is an irregular articular surface for the fibula. The hole for the medullary artery in the middle and back part.

Connexion. Above with the condyles of the os femoris, below and to the inner side with the astragalus, and on the outside above and below to the fibula.

The *muscles* attached to this bone are ten; viz. below the *tubercle*, M. sartorius, gracilis, semitendinosus; to the back of tsix

the *head,* M. semimembranosus; to the *back of the head and body,* M. popliteus, gastrocnemius internus, tibialis posticus, flexor longus digitorum pedis; and to the *fore part of the head and body,* M. tibialis anticus: extensor longus dig. ped.

THE SPLINT BONE. *Fibula.*

Situation. On the outside of the leg, and forming a splint or support to the tibia.

Description. The fibula is of a very irregular shape, and is composed of a head, body, base, and three articular surfaces; the head, *caput,* or upper extremity, is large and irregular, it has a smooth articular surface on its inner side facing upwards and inwards to join it with the tibia, and on the upper and outer part a little projecting process, *processus bicipitalis,* for the attachment of the M. biceps flexor cruris; the body, *corpus,* consists of several ridges and depressions for the origin and lodgement of muscles; it becomes larger at the base, *basis,* which is smooth in front, and covered only by skin; on its inner side is an irregular articular surface to join it with the outside of the base of the tibia; below the base is lengthened to form the outer ankle, *malleolus externus,* on the inside of which is an oblique articular surface facing downwards and inwards for the outside of the astragalus; the extreme outer point gives attachment to ligaments, and the posterior part is grooved for the tendons of the M. peronei. The medullary artery enters in the middle of the posterior part of the bone.

Connection. On its inside above to the tibia, and below to that bone and the astragalus.

The *muscles* attached to this bone are eight: viz. to the *processus bicipitalis,* M. biceps flexor crucis; to the *fore part of the body,* M. extensor longus digitorum & extensor proprius pollicis pedis; on *the outside,* the M. peroneus longus & brevis; and *behind,* the M. gastrocnemius internus, tibialis posticus, & flexor longus pollicis pedis.

3. THE FOOT. *Pes.*

Consists of the TARSUS, METATARSUS, and TOES.

THE TARSAL-BONES, *Tarsus,*

Like the carpus, is forming a kind of arch, under which tendons, vessels, and nerves pass into the sole of the foot. It consists of seven bones, the astragalus, os calcis, os naviculare, three ossa cuneiformia, and the os cuboides; the four last bones are placed in a row and support the metatarsus.

THE ASTRAGALUS. *Astragalus.*

Situation. At the upper and back part of the foot and connecting it with the leg.

Description. Said to resemble an ancient die; it has six articular surfaces; it is convex above from behind to before, forming its largest articular surface for the base of the tibia; on the inside it has a small articular surface nearly flat, for the inner malleolus; and on the outside it has a large articular surface concave from above downwards and pointed below, for the outer malleolus: the fore part of the bone is rounded, forming the head, which is smooth, to articulate it with the os naviculare: the under part of the bone has two articular surfaces for the os calcis, separated by a deep groove, the posterior concave from within to without, and the anterior slightly convex: those parts of the bone not occupied by articular surfaces are marked by ligament.

Connection. By its upper articular surface with the base of the tibia, on the inner side with the inner malleolus, on the outer with the outer malleolus; below with the os calcis, and before with the os naviculare.

The only *muscle* attached to this bone is M. tibialis posticus.

THE HEEL BONE. *Os Calcis.*

Situation. At the back, outer, and under part of the foot, projecting backwards to form the heel.

Description. The os calcis is the largest bone of the foot; it is of an irregular figure; it has three articular surfaces, is flat on the outside and concave on the inside; it is much lengthened behind to form the heel, or tuberosity, *tuber;* on the upper and fore part where the bone appears concave, are two articular surfaces for the astragalus, the posterior convex and the anterior concave, the inner edges of which project much inwards, and form with the inside of the tuberosity a deep cavity, the *sinuosity,* through which the flexor tendons pass into the sole of the foot; at the fore and outer part of the bone is an irregular concave articular surface for the os cuboides.

Connection. By the two superior articular surfaces with the astragalus, and by the anterior with the os cuboides.

x ten The *muscles* attached to the os calcis are ~~seven~~ viz. to the *upper part* M. extensor brevis dig. pedis; to the *under part,* M. abductor, flexor brevis & adductor pollicis ped., flexor brevis & f. digitorum accessorius, & abductor minimi digiti; to the back part M. Gastrocnemius Ext & int: & plantaris.

NAVICULAR BONE. *Os Naviculare.*

Situation. On the inner and upper part of the foot before the astragalus.

Description. In shape resembles a boat, broad laterally, narrow from before to behind; it has three articular surfaces, one behind deep concave for the astragalus; another before convex, divided by two ridges for the three ossa cuneiformia; and on the outer edge of the articular surface for the outer cuneiform bone, a small articular surface for the os cuboides; on the inner side of the bone is a strong projecting rounded process.

Connection. Behind with the astragalus, before with the ossa cuneiformia, and on the outer edge with the os cuboides.

The *muscle* attached to this bone is, to its *under* part, M. tibialis posticus.

The other four bones are placed in a row and join the tarsus with the metatarsus.

CUNEIFORM BONES. *Ossa Cuneiformia.*

Situation. On the inner and upper part of the foot; they are three in number, and are called from their position, *inner*, *middle*, and *outer* cuneiform bones.

Description. The *inner* cuneiform bone is the largest of the three, it is of an irregular prismatic shape, its base placed below and the apex above; it has four articular surfaces, one behind concave to form part of the articulation for the navicular bone; it has a plain articular surface before for the metatarsal bone of the great toe; its inner surface is slightly convex, and has a smooth surface on its under and fore part, to which the M. tibialis anticus and peroneus longus are inserted; its outer surface is irregularly concave, and has on its upper edge an irregular flat articular surface for the middle cuneiform bone, and a smaller surface before it, for the inside of the metatarsal bone of the second toe: its under surface and the other parts not smooth for articulation, are strongly marked by ligament.

The *middle* cuneiform bone, which is of a prismatic shape and the smallest of the three, has its base above slightly convex laterally; it has four articular surfaces, one behind concave for the navicular, one before flat for the base of the second metatarsal bone, one on the inside nearly flat for the inner cuneiform, and one on the outer and posterior part slightly concave for the outer cuneiform bone.

The *outer* cuneiform bone, in shape resembling the preceding and having its base upwards, has five articular surfaces, one concave behind for the navicular; one before for the third metatarsal; two on the inside, the posterior of which is for the middle cuneiform, and the anterior for the second metatarsal; and a large one on the outside for the cuboid bone.

Connection. The three cuneiform bones form a cup, into which is received the rounded articular surface of the navicular bone; before, they join with the three larger metatarsal bones, and in consequence of the shortness of the middle cuneiform bone a kind of mortise is formed by the inner and outer, in which the second metatarsal bone is received like a tenon; the middle cuneiform bone articulates on the inside with the inner, and on the outside with the outer cuneiform bones; and the outer cuneiform joins by its outer surface with the cuboid bone.

The *muscles* attached to these bones are five; viz. to the *inner,* M. tibialis anticus & peroneus longus; to the *outer,* M. flexor brevis & adductor poll. ped.; and to *all three bones,* M. tibialis posticus.

CUBOID BONE. *Os Cuboides.*

Situation. On the outer part of the foot, immediately before the os calcis.

Description. Of an irregular cuboidal form, its outer edge being the shortest; it has three articular surfaces, the largest of which is behind and concave for the os calcis, the anterior slightly concave and divided by a middle perpendicular ridge into two for the fourth and fifth metatarsal bones, and the smallest on the inside divided by a ridge into two unequal portions, of which the smaller and posterior is for the outer and under edge of the navicular, and the larger anterior for the outer side of the outer cuneiform bone: above, the bone is convex, and below it has a deep groove through which the tendon of the M. peroneus longus plays; the ridge which bounds this behind terminates externally in a protuberance, the posterior part of which marks its junction with the os calcis.

Connection. With the fore part of the os calcis behind, with the two small metatarsal bones before, and on the inside behind with the navicular, and before with the outer cuneiform bones.

The *muscles* attached to this bone are two; viz. on its *under* surface, M. flexor brevis minimi digiti & adductor poll. pedis.

THE METATARSAL BONES. *Metatarsus.*

Situation. Between the tarsus and toes.

Description. The metatarsus consists of five bones, of which the *first,* or that of the great toe, is the shortest and

largest, and that of the *second* the longest; like the metacarpus they have *bases*, the broadest and hindmost part, all which have *flat articular surfaces* to join them with the tarsus; and *heads*, or anterior *rounded articular surfaces* for the phalanges; the middle part is the *body*, which is sharp above and broad beneath; they have also articular surfaces on the sides of their bases; the *first* has one on the *outside* for the second; the *second* has *two* on the *inside*, a small one above for the inner cuneiform, and a large one below for the first metatarsal, also *two* on the *outside*, the upper one for the third metatarsal bone, and a small portion of the upper of these articulates with the outer cuneiform bone; the *third* has *two* on the *inner side* for the second, and *one* on the *outer side* for the fourth; the *fourth* has *one* on *each* side for the third and the fifth; and the *fifth* has one on the inside for the fourth; the fifth metatarsal bone is also remarkable for a tuberosity on its outer part which projects very much, gives attachment to a strong ligament which supports the arch of the tarsus on the outside, and marks its junction with the os cuboides, which is immediately behind it.

The *Connection* of the metatarsal bones has been given in their description.

The *muscles* attached to them are fourteen; viz, the M. interossei (seven) & transversalis pedis, common to all; to the *first metatarsal* are attached M. tibialis anticus & peroneus longus; to the second, M. adductor poll. ped.; and to the fifth, M. peroneus brevis, abductor & flexor brevis minimi digiti.

THE TOES. *Phalanges Digitorum Pedis.*

Situation. Before the metatarsus.

Description. They consist of fourteen bones, of which there are but two rows to the great toe, *pollex pedis*, and three to the other toes; their division is similar to that of the fingers, into base, body, and head, but they are much shorter and flatter.

The *muscles* attached to them are nineteen; viz. *above*, M. extensor proprius pollicis & extensor longus & brevis digitorum pedis, interossei (seven); *below* M. flexor longus & brevis & abductor pollicis, flexor longus & brevis digitorum & lumbricales (four.)

SESAMOID BONES. *Os Sesamoidea.*

Of these there are two at the base of the first phalanx of the great toe, giving insertion to the M. flexor brevis & abductor pollicis ped.

CHAPTER V.

Of the Head.

The bones of the Head, *caput*, are twenty-two in number, and are usually divided into those of the SKULL, *cranium*, and FACE, *facies;* some of them are in pairs, but others are only single bones.

To the Skull there are two pairs and two single bones; viz.

2 Ossa parietalia.
2 Ossa temporum.
1 Os frontis.
1 Os occipitis.

To the Skull and Face two single bones are common; viz.

1 Os ethmöides.
1 Os sphenöides.

To the Face there are six pairs and two single bones; viz.

2 Ossa malarum.
2 Ossa maxillaria superiora.
2 Ossa nasi.
2 Ossa lachrymalia.
2 Ossa palatina.
2 Ossa turbinata.
1 Vomer.
1 Os Maxillare inferius.

All these bones, with the exception of the ossa temporum and os maxillare inferius which form a ginglymoid, or hinge joint, are united by that species of SYNARTHROSIS, which is called SUTURE, from its resemblance to the stitches of a seam. And here would seem to be the proper place to describe the sutures, but as they cannot be well explained, till the processes of the different bones of the head have been spoken of, it has been deemed best to defer the description of them, till the student have obtained a perfect knowledge of the separate bones of the skull and face.

[illegible]

[illegible] Cameron [illegible] 11th Oct 1826

THE BONES OF THE SKULL,

Strictly so called, have been beforementioned as two pairs and two single bones.

FRONTAL BONE. *Os Frontis.*

Situation. In the anterior superior part of the skull, forming the forehead and part of the temples above, and to the sides; and the roof of the orbits below.

Description. The os frontis nearly resembles in shape, a clam shell: it is convex and regular before, concave and slightly irregular behind: convex from before backwards, and from side to side above; and irregularly concave below.

On the *External Surface,*

It is naturally divided into two portions by the superciliary ridges, *arcus superciliares,* situated at the most anterior inferior part of the bone; that which is above the ridges is called, the *fronto-temporal portion;* and that behind them, the *ethmoido orbital portion.*

In the Fronto-Temporal Portion are found,

Immediately above the superciliary ridges the two frontal prominences, *protuberantiæ frontales,* just above the inner corners of the orbits, and marking the situation of the frontal sinuses, *sinus frontales*: about an inch above them and rather to their outer side are two other projections which mark the beginning of ossification: extending upwards and backwards from the lowest part of the bone, in the mesial line is seen a slight ridge more or less projecting, marking the place at which the bone was divided into two portions in the young subject, and also part of the course of the longitudinal sinus of the dura mater within the skull: the sides of this portion forming the temples are separated from the forehead, by the temporal arches, *arcus temporales,* which at first are very strongly marked below, and become less distinct as they pass upwards and backwards; the hollows below form parts of the temporal pits, *fossæ temporales,* in which the M. temporales lay. The posterior edge of the fronto-temporal portion is deeply serrated as far as the temporal arches and bevelled from above downwards and for wards, whilst that below the ridges is squamous and slightly serrated downwards and backwards.

In the Ethmoido-Orbital Portion are found,

In the middle, the nasal process, *processus nasalis,* deeply denticulated, and springing out from it is the nasal spine, *spina nasalis;* behind which is the ethmoidal notch, *incisura ethmoidalis;* at the outer edges of the nasal process are the two internal angular processes, *processus angulares interni,* and rising up from them the superciliary ridges, *arcus superciliares,* with a notch or hole, supra orbitar hole, *foramen supra orbitare,* in each: as the ridges pass upwards, outwards, and downwards, to terminate in the external angular processes, *processus angulares externi,* the bone appears pinched up, which together with the hollows of the temporal pits behind, render the external more distinct than the internal angular processes: behind and between the angular processes are the two orbitar plates, *lamellæ orbitales,* of a triangular shape, the bases in front, the apices behind, and truncated; the orbitar plates are concave from side to side, and deepest close by the external angular processes, forming a cavity for the lachrymal gland, called lachrymal pit, *fossa lachrymalis;* behind the internal angular process is a depression or a spine, sometimes one, sometimes the other, to give attachment to the pulley of the superior oblique muscle of the eye; when a spine, it is called *spina trochlearis:* between the orbitar plates and the edges of the ethmoidal notch are found the openings of the frontal sinuses.

On the *Internal Surface* are found,

In the FRONTO TEMPORAL PORTION, numerous slight eminences and broad shallow depressions produced by the convolutions of the cerebrum, and called from their form mamillary eminences, *eminentiæ mamillares,* and finger-like impressions, *impressiones digitatæ:* from the middle of the anterior part of the ethmoidal notch, the internal spine, *crista interna,* commences, which gives attachment to the dura mater, and projecting sharply backwards, extends upwards about an inch, and divides into two ridges, with a small cavity between them, continued up to the posterior edge of the bone, and called frontal furrow, *sulcus frontalis,* in which part of the longitudinal sinus is lodged: it is said, that when the frontal bone remains divided in the adult, there is no spine: on either side of the spine is a concavity which receives the anterior lobes of the cerebrum, and answers to the prominences marking the commencement of ossification. The upper part of the ETHMOIDO ORBITAL PORTION supports the anterior lobes of the cerebrum, and is marked by eminentiæ mamillares and impressiones digitatæ.

THE FORAMINA in the os frontis are five perfect and six imperfect. The five *perfect* are,

1. *Foramen cæcum,* situated in the inside of the bone at

× ossa maxillaria superiora,

the root of the spine, giving attachment to the dura mater, and allowing the passage of a vein.

2 & 3. The *openings* of the Frontal sinuses, between the ethmoidal notch and the orbitar plates.

4 & 5. *Foramina frontalia*, one behind each internal angular process, through which a branch of the supra orbitary nerve passes into the frontal sinuses. The six *imperfect* are,

1 & 2. *Foramina supra orbitaria*, usually completed by ligament, situated in the superciliary ridges, about one third of their length from the internal angular processes, for the passages of the supra orbitary nerve, artery, and vein.

3 & 4. *Foramina orbitaria interna anteriora*, placed about half an inch behind the lowest edge of the nasal process in each orbitar plate, and giving passage to the ethmoidal branch of the supra orbitary nerve and artery into the ethmoidal cells and skull.

5 & 6. *Foramina orbitaria interna posteriora*, about half an inch behind the anterior, for the passage of the branch of an artery. The four last foramina are completed by the ethmoid bone.

Junctions. The os frontis is joined above and behind with the ossa parietalia, which junction terminates at a line running horizontally backwards from the point of the outer angular process; between those two points and behind as far as the ethmoidal notch, it joins with the sphenoid bone on each side: within the ethmoidal notch it receives the ethmoid bone which joins to the orbitar plates, at the anterior part of which it unites with the os lachrymale; before it joins by its nasal process and spine with the ossa nasi and ethmoid bone, and by its outer angular processes with the malar bones.

The *muscles* attached to the os frontis are three pairs; viz. M. temporalis, corrugator supercilii, orbicularis palpebrarum, and it is also covered by M. occipito frontalis.

PARIETAL BONES. *Ossa Parietalia.*

A pair.

Situation. At the superior and lateral parts of the skull, forming the vertex or top of the head, and parts of the temples.

Description. Externally convex and smooth from before to behind, but rather flat anteriorly, convex from side to side; internally concave from before backwards, and from side to side, and marked by the convolutions of the cerebrum. It is divided into four angles and four edges; the anterior superior, the frontal angle, *angulus frontalis*, sharp; the posterior superior, the occipital angle, *angulus occipitalis*, also sharp; the anterior inferior, the sphenoidal angle, *angulus sphenoidalis*, truncated; the posterior inferior, the temporal angle, *angulus temporalis*, also truncated; in the anterior point of the sphenoidal angle internally is a groove, sometimes a complete canal for the middle artery of the dura mater, which passes upwards and marks the bone with its ramifications: on the posterior point of the temporal angle internally there is a broad groove, for part of the lateral sinus: the anterior edge is called the frontal edge, *margo frontalis;* the superior, the parietal edge, *margo parietalis;* the posterior, the occipital edge, *margo occipitalis;* all three of which are deeply serrated, and the inferior is the temporo sphenoidal edge, *margo temporo-sphenoidalis*, the posterior part of which is slightly serrated and the rest of it squamous; this edge is of a semicircular form, whilst the other three are nearly straight. About two inches above the lower edge, the temporal arch extends backwards from the os frontis in a semicircular direction along this bone, and terminates at the anterior point of its temporal angle. There is usually a mark in the centre of the bone pointing out the beginning of ossification. On the internal surface of the bone, running along the upper edge, is part of a groove for the longitudinal sinus, which is completed when both bones are united, and frequently to the outer edge of this several little pits giving lodgement to the glandulæ pacchionæ.

Foramen. Only one. *Foramen parietale,* near the upper edge for the passage of a vein to the longitudinal sinus.

The only *muscle* attached to it is the M. temporalis, the M. occipito frontalis passes over it.

Junctions. By its frontal edge with the os frontis, by its parietal edge with its fellow, by its occipital edge with the os occipitis, and by its temporo sphenoidal edge with the temporal bone behind, and the sphenoid bone before.

OCCIPITAL BONE. *Os Occipitis.*

Situation. In the posterior and under part of the skull, forming the occiput or hind-head, and part of the base of the skull.

Description. Convex behind, concave before; of an irregular hexagonal figure, the long axis being from above to below: the superior angle sharp, the occipital angle, *angulus occipitalis*, the two superior lateral angles obtuse, the parietal angles, *anguli parietales;* the two inferior angles obtuse, the temporal angles, *anguli temporales*, and the anterior inferior angle truncated, the sphenoidal angle, *angulus sphenoidalis.*

The two superior edges between the occipital and parietal angles, rather convex and serrated, the parietal edges, *margines parietales;* the two lateral edges between the parietal and temporal angles concave and deeply denticulated, the temporal edges, *margines temporales;* the two anterior edges between the temporal and sphenoidal angles also concave and irregularly plane, the basilar edges, *margines basilares.*

The *External Surface* of the Bone

Is smooth above a horizontally curved line which is called the superior transverse arch, *arcus transversus superior;* in the middle of it is the external occipital protuberance, *protuberantia occipitalis externa;* and to these are attached *above* the M. occipito frontales, and *below* the M. trapezii & complexi on each side; about an inch below is the inferior transverse arch, *arcus transversus inferior,* to which is attached the M. splenii, recti postici majores, and obliqui superiores capitis; from the external occipital protuberance passes down perpendicularly the occipital spine, *spina occipitalis,* dividing the posterior inferior part of the bone into two parts, and on each side of it below the inferior transverse arch are the occipital pits, *sulci occipitales,* into which the M. recti postici minores capitis are inserted. The under and fore part of the bone then bifurcates, and diverging forms the posterior part of the great hole, *foramen magnum,* it then converges, forms the fore part of the same foramen, and sends out a strong process anteriorly, the basilar process, *processus basilaris,* which terminates in the anterior angle, and that being truncated and rough, forms the sphenoidal process, *processus sphenoidalis:* on the anterior lateral edges of the foramen magnum are situated the condyloid processes, *processus condyloides,* which are of an irregular oval shape with their axes from before to behind, and facing downwards, outwards, and backwards, so that their anterior and inner edge is the deepest; they are convex from before to behind, and slightly convex from side to side; by them the head articulates with the first cervical vertebra: extending from the condyloid processes laterally outwards and rather backwards to terminate at the temporal angles, is a ridge on each side which gives attachment to the M. rectus lateralis capitis, and before them in the basilar edges, the bone is scooped out on each side to form part of the *foramina lacera basis cranii posteriora:* behind the condyloid processes are the *foramina condyloidea posteriora,* and before them the *foramina condyloidea anteriora.*

The *Internal Surface* of the Bone

Is divided behind the foramen magnum into four cavities by the cruceal ridge, the perpendicular portion of which is called the internal spine, *spina interna*, and the transverse, the transverse spine, *spina transversa*, and where they intersect is the internal occipital protuberance, *protuberantia occipitalis interna:* the internal spine *above* the transverse spine has usually a deep groove on its right side for the longitudinal sinus, and *below* it a narrow groove for the occipital sinus, the transverse spine is more or less hollowed on one or both sides for the lateral sinuses. To the spine above the transverse spine is attached the falx major of the dura mater, and to the same part below, the falx minor is connected; to the transverse spine the posterior edge of the tentorium is fixed. The cavities above the transverse spine are for the posterior lobes of the cerebrum, and those below for the cerebellum, and at their anterior extremities are more or less of the terminations of the grooves for the lateral sinuses in the foramina lacera, with the posterior condyloid foramina opening into each of them. The upper surface of the basilar process is seen hollowed out broader below and narrow above to receive the medulla oblongata, and on its superior edges are seen parts of the *grooves* for the inferior petrosal sinuses.

THE FORAMINA in the os occipitis are five perfect, and two imperfect. The five *perfect* are,

1. *Foramen magnum*, rather of an oval figure, with the long axis from before to behind, through which pass *out* of the skull the medulla oblongata, and the anterior arteries of the medulla spinalis, and *into* it the vertebral arteries and accessory nerves.

2 & 3. *Foramina condyloidea anteriora*, situated within the lateral edges of the foramen magnum, through which the lingual nerves pass.

4 & 5. *Foramina condyloidea posteriora*, by which veins from the back part of the neck enter into the lateral sinuses.

The two *imperfect* are,

1 & 2. *Foramina lacera basis cranii posteriora*, completed by the temporal bone, through which pass the glossopharyngeal, pneumo gastric, and accessory nerves from the skull, and at which the lateral sinus joins with the internal jugular vein.

Junctions. The os occipitis is joined by its parietal edges to the parietal bones; by its temporal edges to the mammillary portions of the temporal bones; by its basilar edges to the petrous portions of the same bone; and by its sphenoidal process to the sphenoid bone.

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The *muscles* attached to the os occipitis are ~~ten~~ eleven pairs; viz. the M. trapezii, complexi, splenii, recti postici majores, & minores capitis, obliqui superiores capitis, recti laterales, recti interni majores, and minores capitis, and occipito frontales.

TEMPORAL BONES. *Ossa Temporum.*

A pair.

Situation. In the inferior, middle, and lateral parts of the skull, forming parts of the temples and cheek.

Description. It is of an irregular shape, thin before and above, and thick behind and below, sending from within a strong triangular process which passes forwards, inwards and downwards, and being of a close texture and rocky hardness, is called the *pars petrosa*, which naturally divides the other part of the bone into two; that which is before and to the outer side of it is called *pars squamosa*, from its being thin like a fish scale; and that which is behind and to its outer side the *pars mamillaris*, from its resemblance to a nipple.

The Pars Squamosa

Is situated in front, it is bounded below by the meatus auditorius externus, which is the largest external hole, and above by the petrous portion.

The superior part of the pars squamosa is very thin, and called the scaly plate, *lamella squamosa;* it forms part of the temporal fossa, from the under and outer parts of which extends the root of the zygomatic process, *processus zygomaticus*, which is thin and narrow, facing downwards and inwards, it passes forwards, curves slightly inwards, is smooth above, but irregular and having a tubercle at its root below, and terminates in a denticulated process, the malar process, *processus malaris;* between the root of the zygomatic process above and the scaly plate is the temporal pulley, *trochlea temporalis*, over which the M. temporalis plays; behind the root of the same process below is the glenoid cavity, *cavitas articularis*, for the articulation of the lower jaw; this is crossed by the glasserian fissure, *fissura glasseri*, and bounded before by the articular eminence, *eminentia articularis*, broadest within, and narrowest without, where it terminates in the tubercle of the zygomatic process, and bounded behind by the auditory process, *processus auditivus*, which forms the floor of the external auditory passage, *meatus auditorius externus;* the auditory process is slightly hollowed to receive part of the parotid gland, and has above it the external auditory hole, *foramen auditivum externum.* Within the squamous part is marked by the convolutions of the middle lobes of the cerebrum, and the edge bevelled off, where it joins with the parietal bone.

THE PARS MAMILLARIS,

Situated at the posterior inferior part of the bone, is bounded before and above by the pars petrosa, and below by the auditory process.

It forms an irregular semicircular ridge above to join with the parietal bone, and behind is deeply denticulated to join with the occipital bone. At the under part it is shaped like a nipple, and called at that part, mastoid process, *processus mastoideus,* upon which is a small groove for the occipital artery, and above it usually is seen the mastoid hole, *foramen mastoideum;* behind the mastoid process is a deep pit, the digastric pit, *fossa digastrica,* from which the M. digastricus arises; to the inner and under part of the mastoid process is placed the styloid process, *processus styliformis,* from which arise three muscles and two ligaments, it is surrounded by its vaginal process or sheath, *processus vaginalis,* from which it may be drawn out: between the root of the styloid process and the fore part of the digastric pit is the stylo mastoid hole, *foramen stylo mastoideum,* the external opening of the canal of that name, which passes through the top of the tympanum, but cannot be seen till a section of the bone be made. On the inside of this part, the mastoid process is deeply hollowed to receive the termination of the lateral sinus: and between it and the squamous part, the substance of the bone is cellular, forming the mastoid cells, *cellulæ mastoideæ,* which are not seen but by making a section of the bone.

THE PARS PETROSA,

Situated on the inside of the bone, passing forwards, inwards, and downwards from the junction of the squamous with the mamillary portions, is of a triangular shape with the base below.

It has three angles and three faces. The *superior angle* has a broad shallow depression near its inner point, over which the trigeminal nerve passes; and, extending along from thence to the upper part of the pit in the mastoid process is a groove for the superior petrosal sinus. In the *anterior inferior angle,* immediately to the inside of the auditory process, is the bony part of the eustachian tube, *tuba eustachiana;* and above it, part of the carotid canal; the extreme inner point is rough to join with the root of the posterior clinoid process of the sphenoid bone. The *posterior*

, and still further out is seen the projection of the vertical semicircular canal.

inferior angle is very irregular, it has a deep notch in it which forms part of the posterior lacerated hole at the base of the skull, *foramen lacerum basis cranii posterius*, and is divided into two by a jutting process, jugular process, *processus jugularis*, which separates the nerves passing through this hole from the jugular vein: in the inner notch, the aqueduct of the cochlea, *aquæductus cochleæ*, opens, presenting a conical cavity with its base facing backwards and downwards. In the *anterior face* is seen to the inner point a slight notch, forming part of the carotid hole, to the outer side of which is the continuation of the groove for the trigeminal nerve, and below it part of the anterior lacerated hole at the base of the skull, *foramen lacerum basis cranii anterius*, which before maceration is filled up by a ligamentous structure, and forms part of the carotid canal: extending outwards and upwards from this is the unnamed canal, *canalis innominatus*, which terminates in the unnamed hole, *foramen innominatum*. In the *posterior face* are, at the extreme inner part, a portion of the *groove* for lodging the inferior petrosal sinus, the remainder of it being situated on the basilar process of the os occipitis; to the outer side of this is seen the internal auditory hole, *foramen auditivum internum*, leading to the internal auditory passage, *meatus auditorius internus*, and still further out, the opening of the aqueduct of the vestibule, *aquæductus vestibuli*, covered by a scale of bone; above and between the aqueduct and the passage is a little pit or pits, to which a process of the dura mater is attached; both these faces are marked by the legs of the vertical semicircular canal immediately above the aqueduct of the vestibule. In the *inferior face* or *base* is the jugular pit, *fossa jugularis*, in shape like a thimble, for the termination of the jugular vein immediately before the notch of the foramen lacerum posterius; and the beginning of the carotid canal is seen before the aqueduct of the cochlea; the posterior inner part of this face is truncated obliquely and irregularly upwards.

The FORAMINA in this bone are ten whole and three imperfect. The ten *perfect* are,

1. *Foramen glenoideum* in the fissura glasseri for the passage of the chorda tympani from the tympanum, and the M. externus mallei into it.

2. *Foramen auditivum externum*, between the auditory and the mastoid process to which the auricle of the ear is attached, and which is the beginning of the bony part of the external auditory passage.

3. *Foramen stylo mastoideum*, between the mastoid and

styloid processes for the passage of the facial nerve from the stylo mastoid canal.

4. *Foramen mastoideum*, generally behind and above the mastoid process, but sometimes found between the temporal and occipital bones, and at other times entirely in the latter bone, though but rarely; it transmits a vein from the integuments of the skull to the lateral sinus.

5. *The opening* of the aquæductus cochleæ.

6. Ditto carotid canal.

7. Ditto eustachian tube.

8. *Foramen innominatum*, in the anterior face of the pars petrosa, for the passage of the nervus innominatus to the beginning of the stylo mastoid canal, to join with the facial nerve.

9. *Foramen auditivum internum*, by which the facial and auditory nerves enter the meatus auditorius internus.

10. The *opening* of the aquæductus vestibuli. The two last holes in the posterior face of the pars petrosa. The *imperfect* foramina, are,

1. *Foramen lacerum basis cranii anterius*, filled in the recent state by ligament, forming part of the carotid canal.

2. *Foramen caroticum* for the passage of the internal carotid artery into the skull.

3. *Foramen lacerum basis cranii posterius* for the passage of the glossopharyngeal, pneumo-gastric, and accessory nerves, and the junction of the jugular vein with the lateral sinus.

Junctions. The os temporis is joined by its malar process to the zygomatic process of the os malæ; by the inferior edge of the pars squamosa to the spinous process of the os sphenoides; by the superior edge of the same part to the temporo sphenoidal edge of the os parietale, by the superior edge of the pars mamillaris to the temporal angle of that bone; by the inferior edge of the pars mamillaris, and by the posterior inferior angle of the pars petrosa to the temporal and basilar edges of the os occipitis; and by the inner point of the pars petrosa to the root of the posterior clinoid process of the os sphenoides.

The *muscles* attached to the os temporis are ~~seven~~ nine teen; viz. M. temporalis, masseter, retrahentes aurem (two), occipito frontalis, sterno mastoideus, trachelo mastoideus, splenius, ? digastricus, stylo hyoideus, stylo glossus, stylo pharyngeus, & constrictor pharyngis superior; and the muscles moving the small bones of the ear, M. tensor tympani, laxator tympani, externus mallei, and stapedius.

The os temporis contains, besides the parts which have

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been described, the organ of hearing, which includes the ossicula auditus, viz. malleus, incus, os orbiculare, and stapes. As, however, these cannot be understood till sections of the os temporis have been made, it will be better to refer the whole to the description of the Ear, p. 430, rather than to describe the organ partially in this place.

ETHMOID BONE. *Os Ethmoides.*

Situation. In the ethmoidal notch of the os frontis, and forming the roof of the nostrils.

Description. The ethmoid bone derives its name from its resemblance to a sieve, being full of holes; it is of a cuboidal figure and made up principally of cells.

The superior surface of the bone is called its crybriform plate, *lamella crybriformis*, which has in the middle the cock's comb, *crista galli*, to which the beginning of the falx major of the dura mater is attached; it is thin and narrow at the back part of the crybriform plate, but as it advances it becomes deeper and broader, where it is sometimes hollowed to form part of the foramen cæcum; on each side of the cock's comb are numerous little holes, the sieve-like holes, *foramina crybrosa;* from the under part of the crista descends the nasal plate, *lamella nasalis,* thick behind, and above, where it joins with the ethmoidal process of the sphenoid bone, thin behind and below where it joins with the vomer, and very much thicker before and above, directly under the crista galli, where it joins with the crista nasalis of the frontal bone; on either side of the nasal plate, which forms a division between them, are the convolutions of the bone, which coalescing form the ethmoidal sinuses, *sinus ethmoidales*, anterior and posterior, the former terminating in the middle, and the latter in the superior chambers of the nose; two of these long convolutions which are nearest to the nasal plate descend further, and are more distinct, with their concavities outwards, are called turbinated plates, *lamellæ turbinatæ;* the spaces between the turbinated plates below, and the under part of the crybriform plate above, are called the superior chambers of the nose, *meatus superiores nasales;* the spaces below them and to their outer surfaces form part of the middle chambers of the nose, *meatus medii nasales:* the ethmoidal sinuses are bounded externally for the most part by the flat plates, *lamellæ planæ*, which form the principal portions of the inside of the orbits, but at the anterior, where the frontal and ethmoidal sinuses send their canals to terminate in the middle chamber, they are covered by the ossa lachrymalia.

The Foramina in this bone are numerous perfect and three imperfect pairs. The *perfect* are

Foramina crybrosa, through which the olfactory and ethmoidal nerves pass to the nose.

The *openings* of the posterior ethmoidal sinuses. The *imperfect* foramina are

1. The *openings* of the anterior ethmoidal sinuses.

2 & 3. *Foramina orbitaria interna anteriora & posteriora,* in the upper edge of the flat plate completed by the os frontis, through the anterior of which the ethmoidal nerve passes up into the skull, and through the posterior an artery and vein to the ethmoidal sinuses.

Junctions. The os ethmoides is joined above by the edges of its crybriform plate to the edges of the ethmoidal notch of the os frontis, and to the os sphenoides; and by the posterior part of its nasal plate to the latter bone and to the vomer; by the fore part of the same plate to the back part of the nasal crista of the os frontis; by the anterior edge of its flat plate with the os lachrymale; and by the lower edge of the same plate with the superior maxillary bone and palate bone.

There are *not any muscles* attached to or covering this bone.

SPHENOID BONE. *Os Sphenoides.*

Situation. In the middle of the skull, immediately behind the bones of the face.

Description. This bone is called sphenoid or wedge bone, because it seems to wedge and lock together all the other bones of the skull. It is divided into the body, *corpus,* two temporal portions, *partes temporales,* and two pterygoid portions, *partes pterygoideæ.*

The Body

Is situated in the middle of the bone, and may be said to resemble an oblong square box, with its long axis from before to behind; it is bounded before by its nasal surface, *facies nasalis,* behind by its occipital surface, *facies occipitalis,* and laterally by a perpendicular line raised from the processus pterygoidei, the most depending part of the bone. On the middle of the upper part of the body is the Turkish saddle, *sella tursica,* concave from before to behind, and in it rests the pituitory gland of the brain; the sella tursica is bounded behind by a broad process, the posterior clinoid process, *processus clinoides posterior,* so called from its supposed resemblance to the nob of a bedstead; it is, however, nearly flat above, with a trifling cavity from side to side; it is bounded before by the *processus olivaris,* olive-shaped pro-

cess, which is usually hollowed, and upon it the optic nerves decussate, or at least join: on each side of this process, and extending back over the sella tursica are the anterior clinoid processes, *processus clinoides anteriores,* two in number, having in their roots the optic holes, *foramina optica;* sometimes the anterior and posterior clinoid processes are united by a slip of bone running from one to the other; at other times a little bony process is sent down from the anterior clinoid processes to the outer edges of the processus olivaris, so that the transverse artery of the brain passes through complete foramina; extending forwards and outwards from the anterior clinoid processes and terminating in points as they pass out, are the transverse spinous processes, *processus transverso spinosi,* which are thin and triangular, their bases attached to the body of the bone, and their points extending outwards: in front of the body is the ethmoidal spine, *spina ethmoidalis;* below and before which is the ethmoidal process, *processus ethmoidalis:* the body contains the two sphenoidal sinuses, *sinus sphenoidales,* divided by a plate of bone and opening into the superior chamber of the nose; on its under surface is the single process, *processus azygos,* on either side of which are the parts called by some anatomists the triangular bones, *ossa triangularia,* and described by them as distinct bones; they merely form the floor of the sinuses and the roof of the spheno palatine holes, *foramina spheno palatina,* by which the spheno palatine nerves pass into the nose: the occipital surface of the bone faces rather downwards and is rough, forming the basilar process, *processus basilaris;* on each side of which is a deep notch, forming part of the foramen caroticum: on each side of the body is a groove for the internal carotid artery.

THE TEMPORAL PORTIONS

Are placed to the outer sides of the imaginary lines above described; they pass first outwards, and afterwards upwards laterally, and forwards: they are hollowed within, and form, with the squamous and petrous portions of the temporal bones, the cavities for lodging the middle lobes of the cerebrum; whilst the anterior ascending part separates the general cavity of the skull from the orbits. Between the anterior inner edge of the temporal portion and the transverse spinous process, is situated the superior lacerated orbitar hole. *foramen lacerum orbitare superius,* of an irregular shape, largest below and to the inside, and becoming pointed as it extends outwards; behind and below it is the round hole, *foramen rotundum;* extending backwards from which is *a groove* for the lodgment of the superior maxillary nerve; more backwards, and to the outer side, is the oval hole, *foramen ovale*, and behind it in the extreme angle, is the spinous hole, *foramen spinosum.* The anterior upraised surface of the pars temporalis forms the orbitar plate, *lamella orbitaris*, of a triangular shape, with the base forwards and outwards, the orbitar plate faces upwards and inwards, forming the back and outer part of the orbit; its lower edge forms the upper margin of the inferior lacerated orbitar hole, or spheno maxillary fissure, *foramen lacerum orbitare inferius.* The outer surface joining at an obtuse angle with the orbitar plate, is the temporal plate, *lamella temporalis*, which forms part of the fossa temporalis; extending back from the temporal fossa is the spinous process, *processus spinosus*, which passes backwards, and dipping down forms a little process, the styloid process, *processus styliformis.*

THE PTERYGOID PORTIONS

Are situated at the under part, on either side of the body of the bone, extending downwards from its junction with the temporal portions: they bound above, and to the sides, the posterior openings of the nostrils. Each pars pterygoidea is divided into two plates, *laminæ*, having between each two the pterygoid pit, *fossa pterygoidea*, which, as the laminæ pass down and separate, terminates in the pterygo-palatine fissure, *fissura pterygo palatina;* the nasal plate, *lamina nasalis*, is the longest, it faces slightly outwards and terminates in a little curved process, the hook-like process, *processus hamularis*, over which the tendon of the M. tensor palati plays: the outer plate is the muscular plate, *lamina muscularis*, which is the broadest and strongest, but shortest; it faces considerably outwards and forwards, and is deeply hollowed behind: on the upper and fore part is seen the beginning of the pterygo palatine canal, *canalis pterygo palatinus*, by which the palatine nerve passes into the mouth; the anterior surfaces of both laminæ are roughly marked where they join with the ossa palati. ✗

THE FORAMINA in the os sphenoides are seven pairs perfect, and four imperfect. The *perfect* foramina are,

1. *Foramina optica*, for the passage of the optic nerves and ocular arteries from the skull.

2. *Foramina lacera orbitaria superiora*, for the passage of the common oculo muscular, inner oculo muscular, opthalmic branch of the trigeminal, and the outer oculo muscular nerves *from* the skull, and the ocular veins *into* it.

3. *Foramina rotunda*, for the superior maxillary branch of the trigeminal nerve.

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4. *Foramina ovalia,* for the inferior maxillary branch of the trigeminal nerve.

5. *Foramina spinosa,* for the middle artery of the dura mater.

6. *Foramina pterygoidea,* at the roots of the pterygoid processes for the passage of the pterygoid nerve.

7. The *openings* of the sphenoidal sinuses on either side of the processus azygos. The *imperfect* are,

1. *Foramina carotica,* in part formed by the temporal, and part by the sphenoid bone for the carotid artery.

2. *Foramina lacera basis cranii anteriora,* with the temporal bone, filled up naturally by ligament.

3. *Foramina spheno palatina,* formed by the sphenoid and palate bones for the passage of the spheno palatine nerve into the nose.

4. *Foramina lacera orbitaria inferiora,* formed by the sphenoid, palate, and superior maxillary bones.

Beside the foramina, the sphenoid bone forms with the os palati the *canalis pterygo palatinus.*

Junctions. The os sphenoides is joined by its ethmoidal spine and process to the nasal plate of the os ethmoides; by its transverso spinous process, and the inner upper edges of its orbitar plates to the orbitar plates and temporal edges of the os frontis; and at the upper and back part of its temporal plates with the sphenoidal angles of the ossa parietalia: by the posterior edges of the same plates and its spinous process, it joins with the squamous portions of the ossa temporum; from its spinous processes to the roots of the pterygoid processes it touches slightly the inferior angles of the petrous portions of the ossa temporum, and by its basilar process with the sphenoidal process of the os occipitis: by the anterior edges of its orbitar plates it joins with the ossa malarum; by the anterior surfaces of its pterygoid plates with the ossa palati; and by the processus azygos to the vomer.

The *muscles* atttached to the os sphenoides are thirteen pairs; viz. the M. levator palpebræ superioris, levator, depressor, abductor, adductor & obliquus superior oculi, temporalis, pterygoideus externus & internus, buccinator, externus mallei, constrictor pharyngis superior, tensor palati.

The os ethmoides and os sphenoides, with the os frontis, ossa parietalia, os occipitis, & ossa temporum, complete the cranium, and form by their union the large cavity in which the brain and its membranes are placed, and this is called the BRAIN CASE.

CHAPTER V.

Of the Sutures and the Basis of the Skull.

The Skull is said to be of an ovate shape, the narrowest part being in front, and the broadest behind; it is arched symmetrically above from before to behind, and from side to side; it is irregularly concave below. Its anterior part, which is more or less perpendicular and broad, is called the forehead, *frons;* its upper part, which is generally flat, the top of the head, *vertex;* and behind it is the hind head, *occiput;* the sides of the head are usually called the temples, *tempora;* the boundaries of which are, the temporal arches upon the frontal, parietal, and temporal bones; and the inferior surface forming the floor of the skull is called the external base, *basis externa,* which assists in forming several parts hereafter to be described and considered as belonging to the face. The bones of the skull, by their union with each other, form that sort of junction, which is called *suture,* resembling very nearly the stitches employed in joining one piece of cloth to another; it is a kind of digitation or receiving of the small finger-like processes, formed by the edge of one bone, into those of the other; and the joint so produced is very strong and completely motionless.

OF THE SUTURES, *Suturæ,*

There are seven; viz. the CORONAL, SAGITTAL, LAMBDOIDAL, two SQUAMOUS, ETHMOIDAL, and SPHENOIDAL.

1. *Sutura coronalis,* so called from being situated at that part of the head, upon which the ancients were used to place the laurel or olive crown, given to the victors in their games. It commences about an inch behind the external angular process of the os frontis, passes vertically over the skull, but rather inclining backwards, and descends to terminate at the same point on the opposite side of the skull. It joins the os frontis with the two ossa parietalia.

2. *Sutura sagittalis.* Named from its straight course. It commences from the middle of the highest part of the coronal suture, runs directly backwards, and terminates at the occipital angle of the os occipitis; this termination is known in the living subject by continuing round the head that horizontal line from which the coronal suture takes its origin.

It joins the two ossa parietalia. The sagittal suture is occasionally continued down the os frontis to the nasal spine of that bone; this part of it then is called the *frontal suture*.

3. *Sutura lambdoidalis* receives its name from its resem-to the Greek Λ. It commences at the termination of the sagittal suture, and extends down into the posterior part of the foramen lacerum basis cranii posterius on each side. The situation of this suture may be described, by carrying a line from the termination of the sagittal suture downwards, and outwards, immediately behind the root of the mastoid process, on each side of the skull. It joins the os occipitis with the ossa parietalia above, and the partes mamillares of the ossa temporum below. By some anatomists the junctions of the os occipitis with the ossa temporum, are called *additamenta suturæ lambdoidalis.* In the lambdoidal suture, and not unfrequently in the sagittal, are found several little bones, which, from being of a triangular form, have been called *ossa triquetra:* they are not, however, to be considered distinct bones, but merely loose pieces, which by accident have not become ossified to the adjacent bone.

4 & 5. *Suturæ squamosæ.* So named from the overlapping of the bones like fish scales. One on each side commences about a quarter of an inch behind the lowest part of the coronal suture, rises up a little, and forming part of an arch, descends and terminates in the lambdoidal suture, at the posterior superior point of the pars mamillaris of the os temporis. It joins the os temporis with the os parietale. That part of the suture, which connects the pars mamillaris of the os temporis with the temporal angle of the os parietale, is sometimes called *additamentum suturæ squamosæ;* the junction at this part is rather denticulated than serrated, whilst the superior part of the suture is scaly, the edge of each bone being bevelled off, in such way, that though one bone overlaps the other, still there is no increase in the thickness of the skull opposite the squamous suture.

6. *Sutura ethmoidalis.* This unites the crybriform plate of the os ethmoides, to the orbitar plates of the os frontis.

7. *Sutura sphenoidalis.* This suture is very extensive. It commences at the junction of the outer edge of the spinous process of the os sphenoides, with the inner edge of the glenoid cavity of the os temporis, passes a little forwards and upwards, and then directly upwards to the anterior part of the squamous suture, joining the temporal plate of the os sphenoides with the anterior part of the squamous portion of the os temporis; is then continued downwards and forwards, joining the upper edge of the temporal plate of the

os sphenoides with the sphenoidal angle of the os parietale, and that edge of the os frontis which is found in the temporal fossa; it passes across the skull from the anterior point of that sphenoidal angle of one os parietale, to the same part of the other, and in its course joins the upper edges of the orbitar plates, the transverso spinous, and ethmoidal processes of the os sphenoides, with the orbitar plates of the os frontis, and the crybriform plate of the os ethmoides; and it is continued between the frontal, parietal, and temporal bones above, and the sphenoid below, to terminate at the inside of the glenoid cavity.

Some of the Sutures are very important, as they describe the course of the vessels of the brain; thus the sagittal suture, points out that of the longitudinal sinus; the anterior superior point of the squamous suture contains the middle artery of the dura mater; the posterior inferior point of the same suture denotes the passage of the lateral sinus on each side; and a horizontal line extended round the os occipitis, from that point of one to the same point of the other suture describes the course of the same sinus along the inside of the os occipitis; and defines the spot to which the tentorium is attached posteriorly. And so if a line be continued from the posterior termination of the sagittal suture to this line, and another from the anterior point of the same suture, down to the nasal process of the os frontis, the whole course of the longitudinal sinus is completely described. These are points which, though seemingly trivial in themselves, are, as connected with surgical practice, of the highest importance, and therefore particularly to be attended to.

In order to see the parts within the skull, it is necessary to make a transverse section of the os frontis, ossa parietalia, and os occipitis; this should be commenced about half an inch above the superciliary ridges, and carried through the tops of the squamous sutures, through the parietal angles and upper part of the os occipitis. The vault of the cranium, thus removed, is called the skull-cap, *calvarium;* and the lower part on which the brain rests, the internal basis, *basis interna.* In the [illegible]

CALVARIUM.

The parts to be observed are the longitudinal groove, *sulcus longitudinalis,* for the longitudinal sinus, with a number of little pits, more or less deep, in which the glandulæ pacchionæ are situated: there are also the impressiones digitatæ

and eminentiæ mamillares, produced by the convolutions of the brain.

BASIS INTERNA.

The internal basis is divided into three portions, the anterior, or *frontal;* the middle, or *sphenoido temporal;* and the posterior, or *occipital.*

1. *Portio frontalis* is bounded before and to the sides by the fronto temporal portion of the os frontis, and behind by the transverso spinous processes of the os sphenoides. It has in the middle in front, the spine of the os frontis, to which the falx major of the dura mater is attached; at the root of which is the foramen cæcum; and behind it, the crista galli; to both of which, the falx is also attached; on each side of the crista galli is the crybriform plate of the os ethmoides; and further out, the orbitar plates of the os frontis, upon which the anterior lobes of the cerebrum rest.

The Foramina in this division are

Foramen cæcum, for the attachment of the dura mater, and sometimes the passage of a vein.

Foramina crybrosa, for the passage of the olfactory and ethmoidal nerves into the nose,

2. *Portio sphenoido temporalis,* bounded before by the transverso spinous processes of the os sphenoides; on the sides by the squamous portions of the ossa temporum; and behind by the superior angles of the petrous portions of the same bones, and the posterior clinoid process of the os sphenoides. It has in the middle, the sella tursica for the lodgement of the pituitory gland of the brain, bounded behind by the posterior clinoid process; and before, by the two anterior clinoid processes; between which is the processus olivaris; and upon it, the optic nerves join; extending outwards from the anterior clinoid, are the transverso spinous processes; on each side of the sella tursica, but below it, is a groove for the carotid artery, and the cavernous sinus; and below that a shallow groove for the superior maxillary nerve; further out on each side, are the cavities to lodge the middle lobes of the brain; behind, on the anterior surfaces of the petrous portions of the ossa temporum, are seen the juttings of the anterior legs of the vertical semicircular canals, and the canalis innominatus for the nervus innominatus.

The Foramina in this division are

Foramina optica, for the passage of the optic nerves and ocular arteries into the orbits.

Foramina lacera orbitaria superiora, for the passage of the common oculo muscular, inner oculo muscular, opthalmic branch of the trigeminal, and outer oculo muscular nerves, *out* of the skull, and the return of the ocular veins *into* it, to the cavernous sinus.

Foramina rotunda, for the passage of the superior maxillary branch of the trigeminal nerve to the parts about the upper jaw.

Foramina ovalia, for the passage of the inferior maxillary branch of the trigeminal nerve to the parts about the lower jaw.

Foramina carotica, for the entrance of the carotid arteries *into* the skull, and the passage of a branch of the outer oculo-muscular nerve *out* of it.

Foramina spinosa, for the entrance of the middle artery of the dura mater.

Foramina lacera basis cranii anteriora, filled up by membrane, in the recent state, and giving passage to the superficial branch of the pterygoid nerve.

Foramina innominata, for the transmission of the nervi innominati to the stylo mastoid canals.

3. *Portio occipitalis,* bounded before by the basilar process of the os occipitis and the posterior surfaces of the petrous portions of the ossa temporum and behind by the os occipitis. It has in the middle, anteriorly, the basilar process, hollowed out for the pons varolii, and medulla oblongata; behind which is the foramen magnum; and extending up from its posterior edge the perpendicular ridge of the os occipitis crossed by the transverse ridge, by which the bone is divided into four cavities; the two upper for the posterior lobes of the cerebrum, the two lower for those of the cerebellum; the superior angles of the petrous portions of the ossa temporum and the transverse ridge of the os occipitis giving attachment to the tentorium; the former having a shallow groove for the superior petrosal sinuses; the latter a deep one for the lateral sinuses, which last is continued down into the temporal angles of the os occipitis: the perpendicular ridge giving attachment above the tentorium to the falx major, and grooved for the longitudinal sinus, which terminates sometimes in the left, and at other times in the right lateral sinus; the same ridge below the tentorium giving attachment to the falx minor, and slightly grooved for the occipital sinuses.

THE FORAMINA in this division are

Foramina auditiva, for the passage from the skull of the arteries of the labyrinth, the auditory and facial nerves.

Aquæductus vestibulorum, for the evacuation of fluid from the vestibule.

Foramina lacera basis cranii posteriora, for the passage of the glosso pharyngeal, pneumo gastric, and accessory nerves

from the skull; and the junctions of the lateral sinuses with the internal jugular veins.

Foramen magnum, for the passage of the medulla oblongata and anterior arteries of the spinal marrow *from* the skull, and the entrance of the vertebral arteries and accessory nerves *into* it.

Foramina condyloidea anteriora, for the passage of the lingual nerves from the skull to the muscles of the tongue.

Foramina condyloidea posteriora, for the entrance of veins into the occipital sinus.

BASIS EXTERNA.

The external basis, like the internal, is also divided into three portions, the anterior, or *ethmoido frontal;* the middle, or *sphenoido temporal;* and posterior, or *occipital.*

1. *Portio ethmoido frontalis*, bounded before by the superciliary ridges of the os frontis, and behind by the roots of the pterygoid processes of the os sphenoides. It has anteriorly in the middle the nasal spine, and process of the os frontis; bounded by the internal angular processes; behind the spine is the nasal plate of the os ethmoides; on each side of which the lamella turbinata, and convolutions of the same bone, bounded on the sides by its flat plates; to their outer side are the orbitar plates of the os frontis, bounded by its external angular processes before, and by the orbitar plates of the os sphenoides behind.

The Foramina in this division are

Foramina supra orbitaria, for the passage of the supra orbitary nerve and vessels to the forehead.

Foramina frontalia, sometimes only one, for the passage of a nerve into the frontal sinuses.

Foramina orbitaria interna, anteriora, & posteriora, the former two, for the entrance of the ethmoidal nerves into the skull; the latter two, for the passage of small arteries and nerves.

Foramina pterygoidea, for the entrance of the pterygoid nerves into the pterygoid canals.

Openings of the frontal, ethmoidal, and sphenoidal sinuses.

The preceding are not seen in the internal basis, the following are, viz.:

Foramina optica.

Foramina lacera orbitaria superiora.

Foramina rotunda.

2. *Portio sphenoido temporalis*, bounded before by the roots of the pterygoid processes of the os sphenoides and the styloid processes of the ossa temporum behind. It has in

the middle anteriorly, the processus azygos of the os sphenoides; on either side of which and rather behind, are the pterygoid processes of the same bone, divided into two plates by the fossæ pterygoideæ; and to their outer side a flat space for the origins of the M. pterygoidei externi; behind the processus azygos the basilar process of the os occipitis; on its sides, the anterior points of the petrous portions of the ossa temporum; further out the spinous processes of the os sphenoides, and to their outside the glenoid cavities of the ossa temporum, bounded laterally, before by the roots of the zygomatic processes, and behind by the auditory processes of the same bones.

THE FORAMINA in this division are

Foramina ovalia.

Foramina spinosa.

Foramina carotica.

The above seen within the skull, the following not seen, viz.:

Foramina auditiva externa, the beginning of the external auditory passage.

Foramina glenoidea, for the passage of the N. chorda tympani and the tendon of the M. externus mallei.

Openings of the eustachian tubes from the tympanum to the throat.

3. *Portio occipitalis*, bounded before by the styloid processes of the ossa temporum, behind by the os occipitis. It has in the middle, the foramen magnum; to the fore part of which are the processus condyloides; on their outer side, a ridge for the attachment of the M. recti laterales capitis: further out, and rather before, the styloid processes of the ossa temporum, surrounded by their vaginal processes; behind which, and rather more outward, the mamillary processes, having at their roots the digastric pits; the os occipitis marked behind the foramen magnum, by the inferior and superior transverse arches, the spine, protuberance and pits.

THE FORAMINA in this division are

Foramina stylo mastoidea, for the passage of the facial nerves from the stylo mastoid canals.

Foramina mastoidea, for the passage of veins to the lateral sinuses.

The above are not seen on the inside; but the following are,

Foramen magnum.

Foramina lacera basis cranii posteriora.

Foramina condyloidea anteriora.

Foramina condyloidea posteriora.

CHAPTER VI.

Of the Bones of the Face.

THESE consist of six pairs and two single bones.

CHEEK BONES. *Ossa Malarum.*

Situation. At the outer and under part of the orbit and the side of the face forming the prominence of the cheek.

Description. The os malæ is of an irregular figure, it is divided into three faces and five processes:

1. *Superficies malaris,* in front and to the outer side, irregularly convex from before to behind; its anterior inner edge bounded by the maxillary process, *p. maxillaris;* its external posterior edge bounded by the zygomatic process, *p. zygomaticus,* and joining with the malar process of the os temporis to form the zygoma, under which the M. temporalis plays.

2. *Superficies orbitaris,* above forming the internal orbitar process, *p. orbitaris internus,* bounded above and to the outer side by the *p. orbitaris superior,* and below to the inside by the *p. orbitaris inferior.*

3. *Superficies temporalis,* situated behind, irregularly concave, and completing the temporal pit, which is therefore composed of five bones, viz. os temporis, parietale, sphenoides, frontis, and malæ.

There is but one FORAMEN in this bone.

Foramen malare, through which the malar nerve passes.

Junctions. The os malæ is joined by its zygomatic process to the malar process of the os temporis; by its superior orbitar process to the external angular process of the os frontis; by the posterior edge of its internal orbitar process with the orbitar plate of the os sphenoides; and by the inner edge of the same process and the inferior orbitar process with the os maxillare superius.

The *muscles* attached to it are four; viz., M. obliquus inferior oculi, zygomaticus major & minor, masseter: the M. orbicularis palpebrarum extends over it.

SUPERIOR MAXILLARY BONES, OR UPPER JAW. *Ossa Maxillaria Superiora.*

Situation. In the front of the face, between the cheek bones, forming a large part of the orbits, and the fore part of the nostrils, face, and palate.

Description. The superior maxillary bone is divided into body and processes. The *body* is of an irregular figure and hollowed to form the maxillary sinus, *antrum highmorianum vel sinus maxillaris ;* its anterior surface hollowed from above downwards, and from side to side, forming the infra orbitar pit, *fossa infra orbitaris,* in the upper part of which is the infra orbitar hole, *foramen infra orbitare :* the body is bounded above and to the outer side, anteriorly, by an irregularly denticulated process, extending as far as opposite the infra orbitar hole, called malar process, *processus malaris,* which projects most below, and is hollowed behind, for the play of the M. temporalis ; to the inner side and above, springing up from the body, is the nasal process, *processus nasalis,* of a pyramidal form, having in its fore part a hole for an artery ; it is rough above to join with the os frontis, becomes prominent as it descends, and has its inner edge grooved to receive the os nasi ; below which is a notch where the alar cartilages of the nose are attached ; behind, and to the outer side above, the nasal process is concave, to form part of the lachrymal pit, *fossa lachrymalis,* in which the lachrymal sack is placed ; and before it the bone is pinched up so as to form a sharp ridge, behind which, the concavity of the pit descends, becomes wider, and forms part of the nasal duct, *ductus ad nasum ;* between the malar and the nasal processes extending backwards is the orbitar plate, *lamella orbitalis,* of a triangular figure, the base of which facing inwards joins with the flat plate of the os ethmoides ; and at its inner part is the lachrymal notch, *incisura lachrymalis,* in which the os lachrymale is received : its posterior edge forms the lower part of the spheno maxillary fissure, and has in it the beginning of the infra orbitar canal, *canalis infra orbitaris,* which runs along the orbitar plate forwards, and when about half an inch distant from the anterior edge of the orbit, dips down to terminate in the infra orbitar hole : the posterior surface of the bone is rounded, and named the tuberosity, *tuber maxillare,* the inner edge of which is rough to join with the pterygoid process of the os palati, forming with it the palato maxillary canal and hole : from the inner and under part of the body, extends horizontally inwards, the palatine process, *processus palatinus,* thin about and of the Sphenoid Bone.

a finger's breadth, hollowed above from side to side, forming the greater part of the floor of the nose, and hollowed below, to form as much of the roof of the mouth; it becomes much deeper at its inner edge, and rough, to join with its fellow, and form above, the nasal crest, *crista nasalis,* which is grooved to receive the vomer, and extending beyond the bony part of the nostrils, gives attachment to the cartilaginous septum of the nose: below the junction forms the palatine spine, *spina palatina;* at the anterior part of the floor of the nostril, close to the nasal crest, is the *foramen incisivum,* leading to the *ductus incisivus;* and at the back part, the palatine process is deeply notched, to receive the os palati: around the inferior, anterior, and external part of the body are sent down two alveolar processes, *processus alveolares,* divided by alveolar plates, *lamellæ alveolares,* into alveolar cavities, *cavitates alveolares,* of which there is usually eight in each bone, to receive as many teeth: in the alveolar cavity of the second molar tooth, there is usually a hole of communication with the antrum; between the root of the inner alveolar process and the palatine plate, is a groove, along which the palatine artery and nerve pass to the ductus incisivus, which is formed by the junction of a notch in the anterior part of the palatine spine: above the floor of the nostril, and from its outer edge, rises up the side of the body, forming the inner boundary of the antrum, and the nasal process; in the former is the maxillary hole, *foramen maxillare,* by which the antrum communicates with the middle chamber of the nose; and upon the latter, just above and before the termination of the nasal duct, is a horizontal ridge to which the anterior extremity of the os turbinatum is attached.

The FORAMINA in the os maxillare superius are four, and one is formed by the junction of both bones.

Foramen infra orbitare, for the exit of the infra orbitar nerve and vessels from the canal.

Foramen maxillare, from the antrum into the nose.

Foramen incisivum, from the nostril into the ductus incisivus, for the anastomosis of the spheno palatine, and palatine nerves and vessels.

The *opening* from the alveolar cavity of the second molar tooth into the antrum.

Ductus incisivus, formed by the junction of both the superior maxillary bones.

Besides these are found part of the *ductus ad nasum,* of the *fissura spheno maxillaris,* and the anterior opening of the nostril.

Junctions. The os maxillare superius is connected by its malar process with the inferior orbitar process of the os malæ; by the anterior inner edge of its nasal process with the os nasi; and by the ridge on the inside of that process with the os turbinatum; by the upper part of the same process with the nasal process of the os frontis; by the posterior part of the same process, and its lachrymal notch with the os lachrymale; by the inner edge of its orbitar plate with the flat plate of the os ethmoides; by the posterior point of the same plate with the os palati; and by its tuberosity, body, and palatine process to the same bone; by the inner edge of its palatine process with that of its fellow; and by the nasal crest formed by the junction of both bones with the vomer.

The *muscles* attached to it are ten; viz. the M. constrictor pharyngis superior, pterygoideus externus, buccinator, masseter, levator anguli oris, levator, et depressor labii superioris alæque nasi, orbicularis palpebrarum, obliquus oculi inferior, & compressor naris.

NASAL BONES. *Ossa Nasi.*

Situation. Immediately under the nasal process of the os frontis, and between the nasal processes of the ossa maxillaria superiora: these bones are of a small size, narrow and thick above, thin and expanded below, they form the bridge of the nose.

Description. The external surface of the os nasi is slightly concave from above downwards, and convex from before to behind; after it has began to expand, the internal surface is thick above, and concave from before to behind; it has four edges, the superior, *margo frontalis,* thick and deeply denticulated, to join with the nasal process and spine of the os frontis, and the nasal plate of the os ethmoides; its external edge, *margo maxillaris,* grooved, and received into the nasal process of the os maxillare superius; its inner edge, *margo nasalis,* flat, to join with its fellow; and its lower edge, *margo alaris,* thin and irregular, to join with the alar cartilages of the nose.

The *muscles* attached to it are two; viz. the M. occipito frontalis, & compressor naris.

LACHRYMAL BONES. *Ossa Lachrymalia.*

Situation. The os lachrymale is placed at the fore and inner part of the orbit behind the nasal process of the os maxillare superius; and before the flat plate of the os ethmoides; it is of an oblong square shape, and very thin.

Description. Internally it is hollow, and covers the anterior ethmoidal sinuses, forming the ethmoidal plate, *lamella ethmoidalis;* externally it is divided by a perpendicular ridge,

which terminates below in a little hook-like process, into two unequal plates, the posterior, of which the flattest, shortest, and broadest, is called the orbitar plate, *lamella orbitalis;* and the anterior the lachrymal plate, *lamella lachrymalis,* is the most concave and narrow, but the longest.

Junctions. The os lachrymale is joined above, to the internal angular and orbitar plates of the os frontis; behind, to the flat plate of the os ethmoides; below, to the orbitar plate of the os maxillare superius; before, to the nasal process of the same bone; and before and below, to the os turbinatum.

PALATINE BONES. *Ossa Palatina.*

Situation. At the under, outer, and back part of the nostrils, between the ossa maxillaria superiora before, and the pterygoid processes of the os sphenoides behind: they are of a very irregular figure.

Description. The os palati is divided into palatine, nasal, pterygoid, orbitar, and sphenoidal processes: the *processus palatinus,* like that of the superior maxillary bone is deepest on its inner edge, where it joins with its fellow, to complete the back part of the nasal crest above, and the palatine spine below; it projects back, forming a little spinous process, to which a muscle is attached; from the outer edge of the palatine rises up the nasal process, *p. nasalis,* forming part of the walls of the sinus maxillaris, and marked internally by a strong ridge, to which the os turbinatum is attached: behind the nasal process, and facing backwards, and rather outwards, is the pterygoid process, *p. pterygoideus,* having two grooves in it, to receive the pterygoid processes of the os sphenoides, and a middle ridge which enters into the fissura pterygo palatina of that bone; anteriorly this process is rough, where it joins with the tuberosity of the os maxillare superius, and forms with it the palato maxillary canal, *canalis palato maxillaris,* terminating below in the palato maxillary hole, *foramen palato maxillare;* through which the palatine nerve and vessels pass to the palate; sometimes, indeed generally, there is another small hole behind, which is then called palatine hole, *foramen palatinum,* to transmit branches of the same vessels and nerve to the soft palate; above the nasal process, the bone springs out into two processes, divided by a notch, the anterior is the orbitar process, *p. orbitaris,* of a triangular shape, and received between the flat plate of the os ethmoides, and the orbitar plate of the os maxillare superius, to the inner and fore part, and the root of the pterygoid process of the os sphenoides behind, forming a covering to part of the ethmoidal sinuses; the posterior process is the sphenoidal process, *processus sphenoidalis,* which joins to the anterior inferior part of the body of the os sphenoides: the notch between the two processes forms the lower part of the spheno palatine hole, *foramen spheno palatinum,* the remainder of which is formed by the os sphenoides.

The Foramina in this bone are two perfect and one imperfect. The two *perfect* are

Foramen palato maxillare, is the junction of the palatine with the pterygoid process for the passage of the palatine vessels and nerves.

Foramen palatinum, for the passage of branches of the same nerve and vessels. The *imperfect* one is

Foramen spheno palatinum, formed in part by the os palati, and in part by the os sphenoides, for the passage of the spheno palatine nerve into the nose.

Junctions. The os palati joins to its fellow by the palatine process; and by their nasal crest to the vomer: by the anterior part of the palatine process to the same process of the os maxillare superius; by the ridge on the inside to the os turbinatum; by the nasal and pterygoid processes to the body and tuberosity of the os maxillare superius; by its pterygoid, sphenoidal, and orbitar processes to the pterygoid processes and body of the os sphenoides; and by its orbitar process to the same process of the os maxillare superius, and the flat plate of the os ethmoides.

The *muscles* attached to and connected with the os palati, are five; viz. M. buccinator, pterygoideus externus & internus, constrictor pharyngis superior, & azygos uvulæ.

TURBINATED BONES. *Ossa Turbinata.*

Situation. On the outer sides of the cavities of the nostrils.

Description. The os turbinatum is composed of two unequal concave plates, joined together above, with their concavities facing towards each other; the outer plate the narrowest, and joined to the body of os maxillare superius, forming part of the inner wall of the maxillary sinus; the inner plate the broadest, and depending into the nose; its anterior edge slightly concave, and attached to the ridge on the nasal process of the os maxillare superius, just touching the lachrymal plate of the os lachrymale, to complete the nasal duct; its posterior extremity very acute and attached to the ridge on the nasal process of the os palati.

Junctions. Above and to the outer side, with the body of the os maxillare superius; anteriorly, to the nasal process of

× of the nasal process

the same bone, and to the os lachrymale; and posteriorly, to the nasal process of the os palati.

PLOUGHSHARE BONE. *Vomer.*

Situation. Between the cavities of the nose.

Description. The vomer is said to resemble a ploughshare; it is divided into four edges, the superior or *sphenoidal*, the broadest, and hollowed to receive the processus azygos of the os sphenoides; the anterior or *nasal*, grooved to receive the nasal plate of the os ethmoides, and the cartilaginous septum of the nose; the inferior or *cristal* thin to join with the nasal crest of the ossa maxillaria superiora and palatine; and the posterior or *pharyngeal* concave, and facing towards the pharynx.

LOWER JAW. *Os Maxillare Inferius.*

Situation. Below all the other bones of the head, and forming the lower boundary of the face.

Description. The lower jaw is of a semi-elliptical form; it is divided into *rami horizontales* and *rami ascendentes.* The horizontal branches form the lower part of the bone, and together produce a semi-ellipsis, which is usually less than the upper jaw, so as to be received within it; when however the lower jaw extends beyond the upper, the jaw is said to be *underhung:* the diameter of the semi-ellipsis being behind, its points form the angles, *anguli;* extending forwards from which are the *sides* of the jaw: the front, instead of being elliptical, is flattened from side to side, and rather produced below; it is called the chin, *symphysis;* at the parts where the symphysis and rami join, are seen the mental holes, *foramina mentalia;* the sides and chin are about two fingers deep, and terminated above by the *processus alveolares,* divided by *lamellæ alveolares,* into *cavitates alveolares,* of which there are sixteen; the under edges of the rami are gibbous or thick, and rounded: within, the symphysis and rami horizontales form a similar curve; at the back of the symphysis is seen the mental spine, *spina mentalis,* which is sometimes bifid; and extending along the rami, is seen on either side, as far as the last dens molaris, a sharp line for the attachment of the M. mylo hyoideus; behind this the line becomes more obtuse, and gives attachment to the M. buccinator. The ascending branches rise up from the angles, and produce obtuse angles with the horizontal branches; they are broad from before to behind, pass upwards, and terminate in a narrow neck, *cervix;* on each side above which are the condyloid processes, *p. condyloides,* convex and narrow from before to behind, broad and slightly convex from side to side: before the neck is a sharp concavity, into which the M. pterygoideus externus is inserted; this is bounded anteriorly, by the coronoid process, *p. coronoides*, which is angular, it passes down a little way sharp in front, and then divides into two legs, which are lost, one on the alveolar process, and the other on the side of the jaw; about an inch below the middle of the concavity, between the condyloid and coronoid processes, on the inside, are the inferior maxillary holes, *foramina maxillaria inferiora*, having a spinous process, *p. spinosus*, at the inner edge of each, for the attachment of a ligament; and from below this a furrow runs downwards, and forwards, in which a nerve rests. Between the inferior maxillary and mental holes, a canal, the infra maxillary canal, *canalis infra maxillaris*, runs within the bone, under the alveolar cavities, for the lodgement of the dental nerve and vessels.

THE FORAMINA in this bone are two pairs.

Foramina maxillaria inferiora, through which the dental arteries and nerves enter the canal, and the

Foramina mentalia, by which they pass out.

Junction. By capsular and lateral ligaments with the glenoid cavities of the ossa temporum, having an interarticular cartilage between them.

The *muscles* attached to the os maxillare inferius are ~~twelve~~ thirteen pairs; viz. *externally* M. masseteres, depressores anguli oris, depressores & levatores labii inferioris; *internally* M. temporales, pterygoidei externi & interni, buccinatores, mylo hyoidei, genio hyoidei, digastrici, & genio hyo glossi: the M. platysma myoides passes over it.

constrictores pharyngis ~~media~~ superiores

CHAPTER VIII.

Of the Orbits, Nostrils, and Palate.

The Bones of the Head form several cavities, of which are

1. THE ORBITS. *Orbitæ.*

These are two in number and formed for the reception of the organs of vision. They are irregular conical cavities, situated in the upper part of the face immediately below the frontal bone, having their bases facing forwards and outwards and their apices inwards and backwards.

Each orbit is composed of *seven* bones, viz.

Os frontis,
Os sphenoides,
Os ethmoides,
Os maxillare superius,
Os palati,
Os lachrymale, and
Os malæ;

~~Whilst~~ Three single bones and four pairs therefore form both orbits.

Of these *above* is placed the orbitar plate of the os frontis; on the *inside* anteriorly, the nasal process of the os maxillare superius; behind it the os lachrymale; posterior to it the flat plate of the os ethmoides; and in the *back* of the orbit the os sphenoides; *below* anteriorly are the orbitar processes of the os maxillare superius, os malæ & os palati, and on the *outside* the orbitar processes of the os malæ & os sphenoides.

The Foramina in the orbits are, eight pairs,

1. *Superior openings* of the ductus ad nasum,
2. *Foramina frontalia,*
3. ——— *ethmoidea interna anteriora,*
4. ————— *interna posteriora,*
5. ——— *lacera orbitaria,*
6. ——— *optica,*
7. *Posterior openings* of the infra orbitary canals, and
8. The large anterior *openings* of the orbits.

The *fissuræ spheno maxillares* are also found, one in each orbit.

2. THE NOSTRILS, *Cava Nasalia*,

Are double, and composed of *fourteen* bones; *four* single, and *five* pairs, viz.

Os frontis,	Ossa nasi,
Os ethmoides,	—— lachrymalia,
Os sphenoides,	—— maxillaria superiora,
Vomer,	—— palatina, &
	—— turbinata.

The superior maxillary and nasal bones form the *anterior* boundary; the superior maxillary, turbinated and palate bones form the *sides;* the palatine and sphenoid bone form the *posterior* boundary; the *floor* is formed by the superior maxillary and palatine bones; and the *roof* by the sphenoid, ethmoid, and lachrymal bones. The two nostrils are separated from each other by a bony septum formed of the nasal plate of the ethmoid bone, the vomer and the nasal crest of the superior maxillary and palate bones.

Each nostril is divided into three chambers, *meatus.*

1. Superior chamber, *M. superior,* situated above the turbinated plate of the ethmoid bone, between it and the crybriform plate; in it are

The *openings* of the posterior ethmoidal and sphenoidal sinuses.

2. Middle chamber, *M. medius,* situated between the turbinated bone below and the turbinated plate of the ethmoid bone, has in it

The *openings* of the anterior ethmoidal, frontal, and maxillary sinuses.

3. Inferior chamber, *M. inferior,* situated between the floor of the nostril below, and the turbinated bone; has in it

The *opening* of the nasal duct.

Besides these are, the *anterior* and *posterior openings* of the nostrils, which are common to all three chambers.

3. THE PALATE. *Fornix Palatinus.*

The bony structure of the palate consists of two pairs of bones and a single one.

Ossa maxillaria superiora,
Ossa palati, &
Os sphenoides.

The margin is formed by the alveolar processes of the superior and inferior maxillary bones, and the arch of the palate by the palatine processes of the same bone and palate bone.

PECULIARITIES IN THE FŒTAL SKULL.

The bones of the skull in the fœtus are not completely formed; in order that the head may be enabled to mould itself to the form of the pelvis whilst passing through it in parturition.

The *os frontis* is divided into two portions by the continuation of the sagittal suture into the ethmoidal fissure.

The *os temporis* consists only of two portions, which are separate, viz. the squamous and petrous; the mamillary portion not being formed till some years after birth.

The *os occipitis* is divided into four pieces, the crucial ridge not having become ossified.

The *ossa parietalia* have neither their frontal nor occipital angles formed; and consequently two large chasms are formed, one in front with the frontal bone, which is also deficient at that spot; and the other behind with the occipital bone, which is also deficient; these two openings are called the fontanels, *bregmata vel fontanellæ*.

SECTION II.

THE DISSECTION OF THE MUSCLES AND JOINTS OF THE EXTREMITIES.

CHAPTER I.

Of the Muscles of the Upper Extremity.

In the dissection of the Muscles, a knowledge of their boundaries, attachments, and actions, ought to be gained; and as they are especially fitted, and here are chosen, to initiate the student into the practical parts of anatomy, dexterity in the use of the knife ought to be attained.

The only instrument which for the most part will be found necessary, is the knife; and, as skill in its use is essentially requisite in surgical operations, it ought to be preferred wherever it is found not absolutely inconvenient. The scissars are not required in the dissection of the muscles, and seldom in that of other parts; and the fingers should be used instead of the forceps, both because they are better instruments, and because the free use of them cannot be too soon acquired.

For the easy and complete dissection of a muscle, it should be first put upon the stretch, that is, its points of attachment should be separated from each other till it is rendered tense. Besides the necessity of so doing, in order to clean it, there is an advantage gained in learning how to extend a muscle, as it points out in what direction its action will be exerted in order to approximate the parts to which it is fixed. In the next place, a clean cut should be made through the coverings of the muscle, whether of skin or fascia, down to the muscular fibre; and the incision should be carried in the course of the

fibres of the muscle, and, if possible, from one extremity to the other. The skin, or other covering is then to be taken between the fingers and thumb, and drawn from the surface of the muscle, so as to stretch the cellular membrane which connects them, and the edge of the knife is to be carried through this reticular texture, in the course of the fibres, from one end of the muscle to the other; and this is to be repeated with each bundle of fibres, and, if possible, from right to left, until the boundaries of the muscle are displayed.

The Muscles of the Upper Extremity are distributed into regions, on the Trunk, Arm, Fore-Arm, and Hand.

§ 1. ON THE TRUNK.

a. Anterior Thoracic, containing three muscles.

1. M. Pectoralis Major.

Situation. On the fore and upper part of the chest; broad and irregularly triangular. Make a perpendicular incision from the top of the sternum to the ensiform cartilage, and another from the middle of the sternum transversely outwards, along the anterior margin of the arm-pit; turn off the integuments by dissecting transversely upwards towards the clavicle, and downwards towards the cartilages of the ribs.

Origin. By short tendinous fibres from the sternal half of the clavicle, commonly called its *clavicular* portion; from nearly the whole length of ~~the upper and middle~~ bones of the sternum, called its *sternal* portion; and from the cartilages of the fifth and sixth ribs. One slip is frequently joined with the external oblique muscle of the abdomen. Between the sternal and clavicular portions, there is frequently a distinct separation. The fibres extend and converge towards the axilla, opposite to which they have a folded appearance. both

Insertion. By a strong tendon, which crosses the front of the arm-pit, forming its anterior boundary, into the outer ridge of the bicipital groove.

Use. To bring the arm forwards and obliquely upwards, and to rotate it inwards.

Dissect back the muscle from its origin, and expose the M. pectoralis minor & subclavius.

2. M. Pectoralis Minor.

Situation. On the front of the chest, to the outer side of the cartilages of the ribs; it is less than the M. pect. maj., and of a triangular figure.

Origin. Tendinous and fleshy, by three, or sometimes four heads from the third, fourth, and fifth ribs (more rarely from the sixth), near their cartilages. The fibres passing obliquely outwards and upwards, are collected into a short tendon.

Insertion. Into the point of the coracoid process of the scapula.

Use. To pull the scapula downward and forwards; if that be fixed, it raises the ribs.

3. M. SUBCLAVIUS.

Situation. Immediately under the clavicle.

Origin. Tendinous from the cartilage of the first rib. It becomes fleshy, and passes upward and outward under the clavicle.

Insertion. Into the under surface of the clavicle from near its sternal extremity to a point opposite to the coracoid process of the scapula.

Use. To pull the clavicle downwards.

b. LATERAL THORACIC, containing one muscle.

1. M. SERRATUS MAGNUS (serratus major anticus.)

Situation. On the side of the chest, covered in a great degree by the scapula; the clavicle must be dislocated from the sternum, before the whole extent of the muscle can be seen; it is broad and thin.

Origin. By fleshy digitations from the nine uppermost ribs. Its fibres are directed backwards, with different degrees of obliquity.

Insertion. Fleshy into the whole length of the base of the scapula, between the attachments of the rhomboid and subscapular muscles, and especially about the inferior angle of the scapula.

Use. To draw the scapula forwards and downwards; and if that be fixed, to draw up the ribs.

c. DORSO-LUMBAR, containing two muscles.

1. M. TRAPEZIUS.

Situation. Broad and thin, on the upper part of the back and neck; to be displayed by making an incision from the protuberance of the os occipitis perpendicularly down to the sacrum; and another transversely from the spine of the

scapula; turn the skin off by continuing to dissect in the course of the fibres, which pass downwards from above, and upwards from below to the scapula.

Origin. From the protuberance and arched ridge of the os occipitis: from the ligamentum nuchæ, by which it is connected to the opposite muscle: from the spinous processes of the two undermost cervical vertebræ, and from all those of the back, except sometimes the two or three lowest, by short tendinous fibres, which connect it with the opposite muscle of the same name. Its fibres pass obliquely in different directions towards the scapula.

Insertion. Fleshy into the upper and outer part of the clavicle; tendinous and fleshy into the acromion and spine of the scapula.

Use. The upper fibres of the muscles raise the scapula and clavicle; the middle draw it backwards, and the inferior pull it downwards; when the whole muscle acts it raises the point of the shoulder.

2. M. LATISSIMUS DORSI.

Situation. It covers the lower part of the back and the whole of the lumbar region; is of a triangular figure; and to be exposed by making an incision from the loins upwards and outwards, along the posterior margin of the arm-pit.

Origin. By a broad thin tendon from the spinous processes of the seven inferior vertebræ of the back, sometimes from not more than four; at which part it is covered by the lower portion of the M. trapezius; from the spinous processes of all the vertebræ of the loins; from the spinous and oblique processes of the sacrum; from the outer labium of the posterior part of the spine of the ilium, and by tendinous and fleshy slips from the three or four inferior ribs. The superior fibres pass nearly transversely, the inferior run with different degrees of obliquity towards the axilla. Near the inferior angle of the scapula, the fibres collecting, have a folded appearance, and frequently receive an additional slip from that part; it is continued along the back of the arm-pit, forming its posterior margin, and passes before the long head of the M. triceps extensor cubiti, to its

Insertion. By a strong flat tendon into the inner edge of the bicipital groove.

Use. To pull the arm backwards and downwards, and rotate it inwards.

d. DORSO-CERVICAL, containing three muscles, which are exposed at once, by dissecting off the M. trapezius transversely.

1. M. Levator Scapulæ (levator anguli scapulæ: musc. patientiæ.)

Situation. At the posterior and lateral part of the neck.

Origin. By tendinous and fleshy slips from the transverse processes of the five uppermost cervical vertebræ, frequently from four, sometimes from three or two only. These slips unite to form a rounded muscle, which passes outward and downward.

Insertion. Tendinous and fleshy into the superior angle and base above the spine of the scapula.

Use. To pull up the angle of the scapula.

2. M. Rhomboideus Major.

Situation. Between the scapula and spine; this and the following muscle are named from their figure.

Origin. Tendinous from the spinous processes of the five superior vertebræ of the back; its fibres pass with a slight obliquity outwards.

Insertion. Into that part of the base of the scapula which is below the spine.

Use. To draw the scapula directly backwards.

3. M. Rhomboideus Minor.

Situation. Immediately above the former, and sometimes not separated from it.

Origin. Tendinous from the spinous processes of the three, or sometimes two inferior cervical vertebræ, and from the ligamentum nuchæ.

Insertion. Into that part of the base of the scapula which is opposite the origin of the spine.

Use. Same as that of the last.

§ 2. ON THE SHOULDER.

a. External Scapular, containing one muscle.

1. M. Deltoides.

Situation. On the shoulder, producing its roundness; it is strong and of a triangular shape, broad above, and placed to the outer side of the M. pect. maj.; and between the two muscles there is a space below the clavicle filled up by cellular membrane, through which the humeral thoracic artery and cephalic vein pass, and mark the division between the two muscles. To be dissected by making an incision from the acromion perpendicularly down the outside of the arm, about six inches

in length, and turning the skin off by following the course of the fibres downwards and outwards behind, and downwards and outwards before.

Origin. Tendinous and fleshy from the scapular extremity of the clavicle, and from the acromion process of the scapula: and tendinous from the edge of the whole of the spine of the scapula. The fibres converge as they descend, and form strong bundles, which are intermixed with tendon.

Insertion. Tendinous below the pectoralis major, into a rough eminence on the outer side of the os humeri, near its middle.

Use. To raise the arm from the side, to bring it forwards and inwards, and to bring it backwards.

Under the upper part of this muscle, between it and the capsule of the shoulder-joint, is a considerable *bursa mucosa,* which commonly extends forward under the acromion. It is sometimes double.

b. POSTERIOR SCAPULAR, containing four muscles which are exposed by turning off the M. deltoides from its origin.

1. M. SUPRA-SPINATUS.

Situation. In the fossa supra-spinata, and covered as well as the next muscle by a strong fascia.

Origin. Fleshy from the whole of the fossa supra-spinata, from the upper part of the spine, from that part of the base which is above the spine, and from the superior costa of the scapula. It passes under the acromion, forms a strong tendon, which passes over the capsule of the joint, and thereby strengthens it.

Insertion. Into the upper and inner part of the greater tubercle of the os humeri.

Use. To raise the humerus and rotate it outwards.

2. M. INFRA-SPINATUS.

Situation. In the fossa infra-spinata.

Origin. Fleshy, from the dorsum below the spine, from the under surface of the spine, and from that part of the base of the scapula which is below the spine. The fibres pass obliquely towards a middle tendon, which passes forward, and adheres to the capsular ligament.

Insertion. By the above thick and short tendon into the middle part of the greater tubercle of the os humeri.

Use. To raise the arm and rotate it outwards.

Under the tendon of this muscle, between it and the scapula, is a considerable *bursa mucosa.*

3. M. Teres Minor.

Situation. Below the former muscle, and often not very distinct from it: it is small and oblong, having its

Origin. Fleshy from the middle and rounded part of the inferior costa of the scapula. It runs forward under the infra-spinatus, and adheres to the capsular ligament.

Insertion. By a strong short tendon into the under and back part of the greater tubercle of the os humeri.

Use. To roll the arm outwards.

4. M. Teres Major.

Situation. Below the former muscle: it has the same figure, but is of larger size.

Origin. Fleshy from the inferior angle of the scapula, from the dorsum near to it, and from a part of the inferior costa. It adheres to the teres minor and infra-spinatus, then passes obliquely downwards and forwards.

Insertion. By a broad, short, and thin tendon, with the latissimus dorsi, into the inner edge of the bicipital groove, but extending lower down than the tendon of that muscle.

Use. To draw the arm backwards and downwards, and to roll it inwards.

Between the tendon of this muscle, that of the latissimus dorsi, and the bone, is placed a small *bursa mucosa.*

c. ANTERIOR SCAPULAR, containing one muscle.

1. M. Subscapularis.

Situation. Filling completely the venter of the scapula; it is of large size. It cannot be dissected till the arm be taken off from the trunk.

Origin. Fleshy from the whole of the internal surface, which is marked by its fleshy bundles, from all the base of the scapula internally, and from its superior and inferior costæ. The fasciculi, of which the muscle is composed, run with different degrees of obliquity, and are attached to tendinous intersections. They pass outwards, and converge.

Insertion. Into the upper part of the lesser tubercle of the os humeri, by a short, flat, and thick tendon, which adheres to the capsular ligament, and like the tendons of the teres major and minor, and of the supra-spinatus, contributes to give strength to the joint.

Use. To roll the arm inwards.

There are two *bursæ* connected with this muscle. The more considerable is situated at the neck of the scapula and

root of the coracoid process, and is sometimes connected with the capsule of the shoulder-joint: the smaller is placed more anteriorly between the capsular ligament and tendon of the muscle, but is not always found.

§ 3. APONEUROSIS OF THE UPPER EXTREMITY.

It is not necessary to dissect this tendinous expansion throughout its extent, but its different parts may be attended to during the dissection of the regions to which it forms a covering.

The muscles of the upper extremity are covered by a tendinous expansion, or aponeurosis, *fascia brachialis.* It may be traced in muscular subjects from the deltoid muscle, extending over the exterior of the muscles of the upper arm; but it is stronger on the posterior than on the anterior part. At the lower part a process extends inwards from it on each side, which is connected to the ridges and condyles of the os humeri, called the *inner* and *outer intermuscular ligaments,* which, being situated between the flexors and extensors, increase the surface of their attachment.

At the bend of the elbow the fascia brachialis is strengthened by cross fibres, and receives additions from the tendons of the triceps and biceps. It extends over the fore arm, and forms a thicker and stronger covering to the muscles on it than on those of the upper arm, giving off partitions which extend between the muscles, and are attached to the radius and ulna. Towards the lower extremity of the fore arm, and on the fore part, it becomes gradually thinner; but on the posterior part of the fore arm and carpus, it is thickened and strengthened by transverse fibres, which form here the POSTERIOR TRANSVERSE LIGAMENT OF THE WRIST, *ligamentum carpi dorsale annulare posterius.* This ligament is attached to the radius, ulna, os pisiforme, and metacarpal bone of the little finger, and binds down the tendons of the extensor muscles.

§ 4. ON THE ARM.

a. ANTERIOR BRACHIAL, containing three

1. M. CORACO-BRACHIALIS.

Situation. On the inner side, and perforated by the musculo-cutaneous nerve: displayed by turning aside the M. pectoralis major & deltoides.

Origin. Tendinous from the fore part of the coracoid process of the scapula, in common with the short head of the biceps muscle, with which it is connected through a great part of its length.

Insertion. Tendinous and fleshy into the inner part of the os humeri, near its middle. It is sometimes continued into the brachialis internus.

Use. To raise the arm upwards and forwards.

An imperfect *bursa* is formed between its tendon above, and that of the biceps and capsular ligament of the shoulder-joint.

2. M. BICEPS FLEXOR CUBITI.

Situation. In front of the arm: it is a long muscle, consisting of two heads, a longer and a shorter, which remain separated for some way, and are afterwards united: the M. deltoides must be turned off to exhibit its origins.

Origin. The LONG HEAD, *caput longum*, situated on the outer side, arises by a slender tendon from the upper edge of the glenoid cavity of the scapula, passes over the head of the os humeri within the joint, and descends exterior to the capsule between the tubercles, along the bicipital grove, surrounded by a tendinous sheath, derived from the capsular ligament. The SHORT HEAD, *caput breve*, arises tendinous and fleshy from the coracoid process of the scapula, in common with the coraco-brachialis muscle. The two heads are united a little below the middle of the fore part of the os humeri, and form a muscle of which the outline is distinct when covered by the integuments.

Insertion. By a tendinous slip into the fascia of the fore arm and by a strong roundish tendon into the inner side of the tubercle of the radius; but which cannot be distinctly seen till the M. pronator radii teres be removed.

Use. To bend the fore arm upon the upper; it also renders the hand supine.

Along the inner side of this muscle pass the principal vessels of the extremity. These are placed on the anterior part of the arm, to the inner side of the biceps muscle, as far as the bend of the elbow: at this part a division takes place, and during the greater part of the rest of their course, they become situated on either side of the fore arm, in the region of the radius and ulna.

A considerable *bursa* is situated between the lower tendon of this muscle and the tubercle of the radius.

3. M. BRACHIALIS INTERNUS.

Situation. On the anterior surface of the lower half of the arm, and in part covered by the M. biceps.

Origin. Fleshy, from about the middle of the os humeri by two attachments, which extend above the insertion of the deltoid muscle on each side. It forms a strong muscle, which passes over the fore part of the capsule of the elbow-joint, to which it firmly adheres.

Insertion. By a strong short tendon into the coronoid process of the ulna, where it is covered by the muscles in the anterior superficial antibrachial region, which must be removed to see it.

Use. To bend the fore arm.

A *bursa* is sometimes found between the tendon of this muscle, that of the biceps and the capsule of the joint.

b. POSTERIOR BRACHIAL, containing the

1. M. TRICEPS EXTENSOR CUBITI.

Situation. On the back of the os humeri which it covers from the scapula to the elbow.

Origin. By three heads. The LONG HEAD, *caput longum*, arises by a short thick tendon, from the inferior costa of the scapula, immediately above the attachment of the teres minor; it passes down between the M. teres major & minor, having the former before and the latter behind it. The SHORT HEAD, *caput breve*, arises by an acute tendinous and fleshy beginning from the outer and back part of the os humeri, just below the head. The THIRD HEAD is called the *brachialis externus:* it arises by an acute beginning from the back part of the os humeri, near the insertion of the teres major, and behind the insertion of the coraco brachialis. The three heads unite about the middle of the humerus, but continue to adhere to the whole of the posterior surface of the bone, and to the condyles.

Insertion. By a broad thick and strong tendon into the upper part of the olecranon of the ulna.

Use. To extend the fore arm.

Between this tendon and the olecranon is situated a considerable *bursa;* and sometimes one or two smaller ones.

§ 5. ON THE FORE ARM.

a. ANTERIOR SUPERFICIAL ANTIBRACHIAL, containing five muscles, which are to be dissected by making an incision from the inner condyle of the humerus to the middle of the front of the wrist; this exposes the fascia, underneath which are found the muscles.

1. M. PALMARIS LONGUS.

Situation. Most superficial, and immediately under the fascia, towards the inside of the fore arm; is very small and often wanting.

Origin. Tendinous from the inner condyle of the os humeri. It soon becomes fleshy, and about the middle of the fore arm sends off a slender flat tendon, which runs very superficially.

Insertion. Into the ligamentum carpi annulare, and aponeurosis palmaris.

Use. To render the aponeurosis palmaris tense.

This *aponeurosis palmaris* should now be displayed; but first must be dissected; the

M. PALMARIS BREVIS.

Situation. On the inside of the hand, amongst the fat, in the inner palmar region (see page 87); it is small and very easily cut away.

Origin. From the ligamentum carpi annulare and aponeurosis palmaris, by small transverse fibres.

Insertion. Into the os pisiforme, and in the skin and cellular membrane which cover the abductor minimi digiti.

Use. To contract the skin on the inside of the hand.

The palmar fascia, *aponeurosis palmaris*, covers the palm of the hand; it is of a triangular figure, and spreads from the annular ligament to the fingers, but becomes gradually thinner before and at the sides. It seems to be formed in most instances by the spreading out of the fibres of the tendon of the palmaris longus, with the addition of some transverse fibres; but this is not always the case; for although the palmaris longus is not unfrequently wanting, the aponeurosis is always found.

The other muscles in the anterior superficial region of the fore arm, the dissection of which is now to be prosecuted, are

2. M. PRONATOR TERES.

Situation. The most exterior and superior of the muscles arising from the inner condyle; it passes across to the outside of the fore arm.

Origin. Tendinous and fleshy, from the inner condyle of the os humeri, and tendinous from the coronoid process of the ulna, passes obliquely downward and outward.

Insertion. Tendinous and fleshy into the outer and back part of the radius near its middle.

Use. To render the hand prone.

3. M. FLEXOR CARPI RADIALIS (radialis internus.)

Situation. To the inner side of the last muscle.

Origin. Tendinous and fleshy from the inner condyle of the os humeri, and from the fore and upper part of the ulna, where it adheres at the sides to the flexor sublimis and pronator teres. It passes downward, terminates about the middle of the fore arm in a long flat tendon, which passes behind the ligamentum carpi annulare, and through the groove in the os trapezium.

Insertion. By a flat tendon into the front of the base of the metacarpal bone, sustaining the fore-finger.

Use. To bend the hand, and assist in its pronation.

Between the tendon of this muscle, the os trapezium, and the ligamentum carpi, is situated a *bursa.*

4. M. FLEXOR DIGITORUM COMMUNIS SUBLIMIS (perforatus.)

Situation. Between the last muscle, which partly covers it, and the M. flexor carpi ulnaris.

Origin. By a tendinous and fleshy head, from the inner condyle of the os humeri, and adheres to the capsule of the joint; likewise tendinous from the inner edge of the coronoid process of the ulna, and from the fore part of the radius near the extremity of the supinator brevis. Near the middle of the fore arm it is divided into four fleshy bellies, each of which sends off a slender tendon. The tendons pass under the ligament of the wrist through the palm.

Insertion. Into the front of the second phalanges of the fingers, near their extremities, after being divided near the middle of the first phalanges, to form a passage for the tendons of the flexor profundus.

Use. To bend the first and second joints of the fingers.

5. M. FLEXOR CARPI ULNARIS.

Situation. The innermost muscle in this region, having to its outer and fore part the last muscle.

Origin. Tendinous from the inner condyle of the os humeri, and fleshy from the inner side of the olecranon of the ulna. It passes along the inner side of the ulna, to which it adheres above. It receives also additional fibres from the aponeurosis of the fore-arm.

Insertion. By a short strong tendon into the os pisiforme.

Use. To bend the hand inwards.

Between the tendon of this muscle and the os pisiforme a *bursa* is found.

b. ANTERIOR DEEP ANTIBRACHIAL, containing three muscles which cannot be seen till those in the superficial region have been removed.

1. M. FLEXOR DIGITORUM COMMUNIS PROFUNDUS (perforans.)

Situation. Immediately behind the M. flexor dig. com. sub.

Origin. From the upper two-thirds of the outer side of the ulna, and from a considerable portion of the interosseous ligament. It divides into four fleshy bellies, terminating in an equal number of tendons, which pass behind the ligament of the wrist, through the palm, and through the divisions of the tendons of the M. flexor dig. subl.

Insertion. Into the fore and upper part of the third phalanges of the fingers.

Use. To bend the last joint of the fingers.

It is better to trace the tendons of the two above described muscles to their insertion, by raising the aponeurosis palmaris, and at the same time to dissect the four lumbricales, although these parts are situated in the middle palmar region. (See page 87.) It will be the fittest opportunity likewise to display the ligaments and sheaths connected with the tendons of these muscles. The

M. LUMBRICALES.

Situation. Close to the tendons of the flexor muscles in the palm of the hand; four in number, and named from their resemblance to earth-worms.

Origin. From the outer side of the tendons of the flexor profundus, a little above the lower edge of the annular ligament.

Insertion. By slender tendons, which spread on the outer side of the first phalanges of the fingers.

Use. To assist the action of the long flexors.

§ 6. LIGAMENTS AND SHEATHS OF THE FLEXOR MUSCLES.

ANTERIOR ANNULAR, or TRANSVERSE LIGAMENT, *Ligamentum annulare vel transversum carpi,* consists of transverse and oblique fibres, forming a strong band, which is stretched across between the projecting points of the os pisiforme and os unciforme, to the os scaphoides and os trapezium. The tendons of the flexor muscles of the fingers, and the tendon of the flexor radialis in a sheath of its own, pass behind it.

Behind this ligament is a *bursa*, which begins above the wrist joint, and extends to the metacarpus. It encloses the tendons of both flexors, and sends off processes which surround and loosely connect them.

On the fingers Vaginal Ligaments are found, which consist of transverse, oblique, and decussating fibres, which run over the tendons of the flexors, and are fixed to the edges of the bones of the phalanges. Upon the body of these bones they are thick and strong, but over the joints they are thin, and become weaker towards the extremities of the fingers. On the joints they are frequently called the ANNULAR LIGAMENTS, *Annuli juncturarum ligamentosi*, and the fasciculi between the crucial ligaments of the first and second phalanx, *Annuli cruciati phalangis primæ et secundæ.*

These ligamentous sheaths are lined by Synovial Membranes, which begin a little above the first joint, and extend to the middle of the third phalanx, and form a lubricated surface for the motion of the tendons of the flexors which are contained within them. The tendons are unconnected except by small tendinous processes, called the Accessory LIGAMENTS OF THE FLEXOR TENDONS, *Ligamenta tendinum accessoria*, which arise from the first and second phalanges, run obliquely forwards within the sheaths, and terminate in the tendons of the two flexor muscles.

The dissection of the other muscles in the anterior deep region of the fore arm is now to be prosecuted. They consist, besides the flexor profundus digitorum, of the

2. M. Flexor Pollicis Longus.

Situation. On the outer side of the M. flexor dig. com. prof.

Origin. Fleshy from the fore part of the radius, its attachment extending from the tubercle of the bone to the insertion of the pronator quadratus, and from the interosseous ligament. It has generally another origin by a separate slip from the inner condyle of the os humeri, or from the coronoid process of the ulna. It sends out a strong tendon, which passes with the tendons of the former muscles into the hand, and runs between the heads of the flexor brevis pollicis.

Insertion. Into the second phalanx of the thumb: its tendon being enclosed in a peculiar synovial bursa.

Use. To bend the last joint of the thumb.

3. M. Pronator Quadratus.

Situation. On the lower extremities of the radius and ulna, and crossed by the two last-mentioned muscles; it is named from its figure.

Origin. Broad, tendinous and fleshy, from the inner and fore part of the lower portion of the ulna. Its fibres pass transversely.

Insertion. Into the fore and outer part of the opposite portion of the radius.

Use. To render the hand prone.

c. Posterior Superficial Antibrachial, containing three muscles.

1. M. Anconeus.

Situation. Immediately below the outer edge of the olechranon, of a triangular figure, and covered by a strong aponeurosis, which separates it from the extensors of the hand.

Origin. Tendinous from the posterior part of the outer condyle of the os humeri. It passes downward and inward, and spreads in its descent. The upper edge is commonly connected with the triceps.

Insertion. Broad and fleshy into the ridge on the outer and back part of the ulna, below the olechranon.

Use. To extend the fore arm.

2. M. Extensor Carpi Ulnaris.

Situation. Immediately to the outer side of the anconeus above, and laying upon the whole length of the ulna below.

Origin. Tendinous from the outer condyle of the os humeri, descends along the outer surface of the ulna, and receives from it additional fibres. It terminates in a strong tendon, which passes under the dorsal ligament of the wrist, and over the hand.

Insertion. Into the upper and back part of the metacarpal bone which supports the little finger.

Use. To extend the hand inwards.

3. M. Extensor Communis Digitorum.

Situation. To the outer side of the last muscle.

Origin. Tendinous and fleshy from the outer condyle of the os humeri, where it adheres to the supinator brevis. About the middle of the arm it divides into four fleshy bellies, which terminate in an equal number of long flattened tendons. These pass under the dorsal ligament of the wrist upon the back of the hand, where they become broader and thinner, and are connected by oblique tendinous bands.

Insertion. Into the back part of the phalanges of the four fingers by a tendinous expansion.

Use. To extend the fingers.

There is frequently a separate slip, called M. Extensor Digiti Minimi Proprius, which arises from the ulna, and passes to the little finger.

A *bursa* is situated at the wrist, for the tendon of this muscle, which sends out a synovial sheath with each of the tendons, as far as the roots of the fingers.

d. POSTERIOR DEEP ANTIBRACHIAL, containing four muscles, to see which, it will be necessary to remove the E. carpi ulnaris & digitorum communis; they will then be found placed next each other in the following order, the first described being the outermost, and the last the innermost.

1. M. EXTENSOR OSSIS METACARPI POLLICIS, *Abductor pollicis longus.*

Origin. Fleshy from the upper, outer, and back part of the ulna, from the interosseous ligament, and from the middle of the inner and posterior surface of the radius. It passes over the latter bone, and terminates in a strong tendon, which passes through a groove in the outside of its base, and is confined by the annular ligament.

Insertion. Into the os trapezium, and upper and back part of the metacarpal bone of the thumb.

Use. To extend the metacarpal bone of the thumb outwards.

The tendon of this muscle is surrounded by a *sheath* of synovial membrane.

2. M. EXTENSOR PRIMI INTERNODII POLLICIS, *Extensor brevis minor.*

Origin. Fleshy from the back part of the ulna, and from the interosseous ligament, and descends connected with the former muscle. It terminates in a slender tendon, which passes under the dorsal ligament of the wrist with the former.

Insertion. Into the extremity of the first bone of the thumb, and a part may be traced as far as the second bone.

Use. To extend the first joint of the thumb.

3. M. EXTENSOR SECUNDI INTERNODII POLLICIS, *Extensor major longus.*

Origin. Tendinous and fleshy from the back part of the ulna, and from the interosseous ligament. It sends out a long tendon, which passes through a groove on the back of the base of the radius, and under the dorsal ligament of the wrist, but separately from the tendons of the two muscles last mentioned.

Insertion. Into the second bone of the thumb. Its tendon runs in a synovial *bursa* or sheath.

Use. To extend the second joint of the thumb.

4. M. Indicator.

Origin. Fleshy immediately below the former muscle, from the middle of the back part of the ulna. Its tendon passes under the dorsal ligament, with those of the extensor digitorum communis.

Insertion. Into the back part of the fore finger, in common with the tendon of the extensor digitorum communis.

Use. To extend the fore finger.

c. Radial, containing four muscles.

1. M. Supinator Radii Longus.

Situation. On the outside of the fore arm, and extending half way up the outside of the upper arm, at which part it has the triceps behind, and the brachialis internus before it.

Origin. Fleshy from the ridge on the os humeri, which extends above the outer condyle, and begins in a sharp point as high as the middle of the bone. It covers the extensor carpi radialis longior, and descends on the outer side of the arm. Above the middle of the fore arm it terminates in a slender flat tendon.

Insertion. Into the outer side of the base of the radius, where it is crossed by the tendons of the extensor ossis met., & primi internodii pollicis.

Use. To render the hand supine, and assist in flexing the fore arm.

2. M. Extensor Carpi Radialis Longior.

Situation. Immediately under the former muscle, its relative position before and behind the same.

Origin. Broad and fleshy from the ridge above the outer condyle of the os humeri, below the supinator longus, as far as the outer condyle. It forms a thick fleshy belly, which passes over the outer condyle, and descends along the radius. It sends off a long flat tendon, which takes at first the same direction, then between the tendons of the three extensors of the thumb and the radius, and is continued in an appropriate groove, over the back of the base of that bone under the annular ligament.

Insertion. Into the back part of the base of the metacarpal bone, supporting the fore finger.

Use. To extend the hand inwards, and to assist in supination.

The tendon of this muscle, at the extremity of the radius, is surrounded by a synovial *sheath*, and there is a small *bursa* between its attachment and the metacarpal bone.

3. M. Extensor Carpi Radialis Brevior.

Situation. Covered by the two last muscles, which must be removed to exhibit it.

Origin. Tendinous from the outer condyle of the os humeri, and from the ligament which passes from it to the radius. It descends along the radius, and terminates below the former in a flat tendon, which passes upon the back part of the radius, and under the annular ligament, taking the same course as the tendon of the extensor longior, with respect to the extensors of the thumb.

Insertion. Into the back part of the base of the metacarpal bone of the middle finger.

Use. Same as the last.

Between the bone and its insertion is situated a small *bursa.* The tendons of both the above-described muscles are surrounded by *synovial sheaths.*

4. M. Supinator Radii Brevis.

Situation. Surrounding the head and neck of the radius, and cannot be seen distinctly till the last muscle be removed.

Origin. Tendinous without, and fleshy within, from the outer condyle of the os humeri, and from the outer and upper part of the ulna, and adheres to the capsule of the joint. Its fibres pass obliquely downwards and forwards over the upper part of the radius.

Insertion. Into the upper part of the fore and inner surface of the radius; it surrounds the head, neck, and tubercle of that bone, and extends as far as the insertion of the pronator teres.

Use. To render the hand supine.

§ 7. ON THE HAND.

a. Middle Palmar, containing the aponeurosis palmaris, lumbricales, and the tendons of the flexors of the fingers, has been already described. See pages 80 & 82.

b. Outer Palmar, containing four muscles which form the ball of the thumb.

1. M. Abductor Pollicis.

Situation. Superficialon the outside of the ball of the thumb.

Origin. Tendinous and fleshy from the os trapezium and ligamentum carpi annulare.

Insertion. Tendinous into the outer side of the root of the first bone of the thumb.

Use. To bring the thumb outwards and forwards from the fingers.

2. M. FLEXOR OSSIS METACARPI POLLICIS. *M. Opponens pollicis.*

Situation. Under the abductor pollicis.

Origin. Tendinous and fleshy from the os trapezium and ligamentum carpi annulare.

Insertion. Tendinous and fleshy into the fore and outer part of the metacarpal bone of the thumb.

Use. To oppose the thumb to the fingers.

3. M. FLEXOR BREVIS POLLICIS.

Situation. On the inner and fore part of the metacarpal bone of the thumb, having the tendon of the long flexor running upon it.

Origin. From the os trapezoides, os magnum, and os unciforme of the carpus. It is formed of two fleshy bellies, between which the tendon of the flexor longus pollicis passes.

Insertion. Into the ossa sesamoidea and first bone of the thumb.

Use. To bend the first joint of the thumb into the palm.

4. M. ADDUCTOR POLLICIS.

Situation. Deep seated in the palm, its fibres pass outwards, and are crossed by some of the flexor tendons of the fingers which must be cut away to display it.

Origin. Fleshy from nearly the whole length of the metacarpal bone that supports the middle finger. Its fibres converge so as to give a fan-like appearance to the muscle.

Insertion. Tendinous into the inner side of the root of the first phalanx of the thumb.

Use. To bring the thumb inwards and backwards.

5. M. ABDUCTOR INDICIS.

Situation. Behind the former muscle, and best seen by dissecting between the metacarpal bones of the thumb and fore finger, on the back of the hand.

Origin. From the os trapezium, and from the inner side of the base of the metacarpal bone of the thumb.

Insertion. Tendinous into the outer and back part of the root of the first phalanx of the fore finger.

Use. To draw the fore finger outwards.

c. INNER PALMAR, containing four muscles, of which

1. M. PALMARIS BREVIS,

Has been already described. (See page 80.) The remaining three belong to and form the ball of the little finger, being placed to the inner side of the tendon of the long flexor of the fingers.

2. M. ABDUCTOR MINIMI DIGITI.

Situation. On the inner part of the hand.

Origin. From the os pisiforme and ligamentum carpi annulare.

Insertion. Tendinous into the inner side of the root of the first phalanx of the little finger.

Use. To draw the little finger from the others.

3. M. FLEXOR PROPRIUS MINIMI DIGITI.

Situation. In front of the metacarpal bone and to the outer side of the last muscle.

Origin. From the hook-like process of the os unciforme and adjacent part of the annular ligament.

Insertion. Tendinous into the inner part of the root of the first phalanx of this finger. This muscle is frequently wanting.

Use. To bend the little finger.

4. M. ADDUCTOR MINIMI DIGITI.

Situation. Covered almost entirely by the last muscle.

Origin. Fleshy from the edge of the hook-like process of the os unciforme, and from that part of the annular ligament near to it.

Insertion. Tendinous into the whole length of the inner and anterior part of the metacarpal bone which supports this finger.

Use. To bring the little finger towards the others.

d. INTEROSSEAL.

There is a set of small muscles, which occupy the spaces between the metacarpal bones, and are called M. *Interossei;* they arise from the sides of the metacarpal bones, and are inserted tendinous, partly into the first joints of the fingers, and partly intermixed with the tendinous expansions of the extensor digitorum communis. They are divided into the internal and external, but all extend the first joints of the fingers. The *Interossei interni*, four in number, arise with single heads, and are seen in the palm of the hand. The *Interossei externi*, three in number, have double heads, and are seen both in the palm and on the back of the hand. They may be arranged, each with the name by which it is usually designated, as follows:

M. INTEROSSEI PALMARES, SEU INTERNI:

1. M. PRIOR INDICIS.

Origin. Tendinous and fleshy, from the upper and outer part of the metacarpal bone that sustains the fore finger.

Insertion. Into the outside of that part of the tendinous expansion from the extensor digitorum communis, which covers the posterior part of the fore finger.

2. M. POSTERIOR INDICIS.

Origin. Tendinous and fleshy, from the root and inner part of the metacarpal bone that sustains the fore finger.

Insertion. Into the inner side of the tendinous expansion which is sent off from the extensor digitorum communis, along the posterior part of the fore finger.

3. M. PRIOR ANNULARIS.

Origin. From the outer side of the root of the metacarpal bone that sustains the ring finger.

Insertion. Into the outside of the tendinous expansion of the extensor digitorum communis which covers the ring finger.

4. M. INTEROSSEUS AURICULARIS.

Origin. From the root and outer side of the metacarpal bone of the little finger.

Insertion. Into the outside of the tendinous expansion of the extensor digitorum communis, which covers the posterior part of the little finger.

M. INTEROSSEI DORSALES, SEU EXTERNI BICIPITES:

1. M. PRIOR MEDII.

Origin. Double from the roots of the metacarpal bones that sustain the fore and middle fingers. It runs along the outside of the middle finger.

Insertion. Into the outside of the tendinous expansion from the extensor digitorum communis, which covers the posterior part of the middle finger.

2. M. POSTERIOR MEDII.

Origin. Double from the roots of the metacarpal bones that sustain the middle and ring fingers.

Insertion. Into the inside of the tendinous expansion from the extensor digitorum communis, which runs along the posterior part of the middle finger.

3. M. POSTERIOR ANNULARIS.

Origin. Double from the roots of the metacarpal bones that sustain the ring and little fingers.

Insertion. Into the inside of the tendinous expansion of the extensor digitorum communis, which runs along the posterior part of the ring finger.

THE RELATIVE SITUATION OF THE MUSCLES IN THE PALM OF THE HAND.

Having removed the skin and fat, the fascia palmaris will be seen, its middle portion covering the middle palmar region being the thickest; its outer covering the outer palmar region the thinnest; and upon the inner portion are seen the fibres of the palmaris brevis. After dissecting off the fascia,

In the *first layer* are seen, in the *middle*, the tendons of the flexor sublimis digitorum manus, and along their outer edges and behind them the tendons of the flex. dig. prof. from the outer margins of which the lumbricales are passing towards the fingers: on the *outside* are seen the abductor pollicis, part of the flexor brevis poll. with the tendon of the flexor longus poll. lying upon it, and nearer the middle, part of the adductor pollicis: on the *inside* are seen the abductor and flexor brevis minimi digiti.

In the *second layer*, having removed the abductor pollicis, the flexor tendons of the fingers, lumbricales, and the abductor & flexor of the little finger, are seen, in the *middle* the adductor pollicis, and behind it, part of the abductor indicis; on the *outer* side the whole of the flexor brevis pollicis; and on the *inside* the adductor minimi digiti, and between it and the adductor poll. some of the interossei palmares are seen.

§ 8. TABLE EXHIBITING THE ACTIONS OF THE MUSCLES OF THE UPPER EXTREMITY.

In studying the actions of muscles, it will be necessary to bear in mind that their points of attachment are reciprocally movable upon each other, or may become, alternately, fixed points. But for obvious reasons we can in this place attempt no more than point out the mode in which the points of insertion are made to approach those of the origin of muscles. From this explanation, however, it will be easy to supply the manner in which, on the other hand, the points of origin may be moved upon the points of insertion, when the latter are the fixed points.

In the small space which, consistently with the plan and main purpose of this Manual, could be allotted to the actions of the muscles, it was necessary to confine our explanations to the mode in which these actions produce the *direct* movements. It will not, therefore, be possible to explain the combined action of muscles, by which the various *intermediate* motions are produced, although it will not be difficult in any instance to understand, that if the muscles acting in different directions combine, they will produce a motion intermediate between both; that if for instance the muscles which raise the arm, should act at the same time as the muscles which carry it forwards, the motion produced will be that of carrying it upwards *and* forwards.

For the same reason it will be expedient to omit the successive action of muscles; as those, for instance, by which the direct and intermediate movements of the humerus are made to succeed each other in such a manner, that the point of the elbow shall describe a circle.

The muscles of the upper extremity perform the motions of the bones of the shoulder, of the os humeri, of the fore arm, of the radius, of the hand, of the thumb, and fingers.

The MOTIONS OF THE CLAVICLE AND SCAPULA TOGETHER are *upwards—downwards—forwards*, and *outward—backward* and *inward*. The scapula has besides a motion of *rotation*. The muscles performing these movements may therefore be divided into—*a*. ELEVATORS, *b*. DEPRESSORS, *c*. MOTORS FORWARD, *d*. MOTORS BACKWARD, and *e*. ROTATORS of the Scapula.

a. ELEVATORS.

1. Trapezius.
2. Levator scapulæ.

b. DEPRESSORS.

1. Serratus magnus.
2. Subclavius.
3. Pectoralis major.
4. Pectoralis minor.

c. MOTORS FORWARD.

1. Serratus magnus.
2. Pectoralis minor.
3. Pectoralis major (by moving the humerus.)

d. MOTORS BACKWARD.

1. Rhomboideus major.
2. Rhomboideus minor.
3. Trapezius.
4. Latissimus dorsi (by moving the humerus.)

e. ROTATORS OF THE SCAPULA (so as to raise the point of the shoulder.)

1. Trapezius.
2. Serratus magnus.

THE MOTIONS OF THE HUMERUS are those of *Extension*, or carrying the humerus forward—*Flexion*, or carrying the humerus backward—*Abduction*, or carrying the humerus from the trunk, and raising it from the side—*Adduction*, bringing it towards the trunk—*Rotation*, which consists in turning the humerus upon its axis, either inwards or outwards. The muscles may therefore be divided into—*a.* EXTENSORS, *b.* FLEXORS, *c.* ABDUCTORS, *d.* ADDUCTORS, *e.* ROTATORS inward, *f.* ROTATORS outward.

a. EXTENSORS.

1. Deltoides (anterior portion of.)
2. Subscapularis.
3. Coraco-brachialis.
4. Biceps.
5. Pectoralis.

b. Flexors.

1. Deltoides (posterior portion of.)
2. Teres major.
3. Teres minor.
4. Triceps (long head of.)
5. Latissimus dorsi.

c. Abductors.

1. Deltoides.
2. Supra-spinatus.
3. Infra-spinatus.
4. Subscapularis.

d. Adductors.

1. Pectoralis major.
2. Latissimus dorsi.
3. Teres major.

e. Rotators inward.

1. Subscapularis.
2. Deltoides (ant. portion of.)
3. Latissimus dorsi.
4. Teres major.

f. Rotators outward.

1. Infra-spinatus.
2. Teres minor.
3. Deltoides (posterior portion of.)

The Motions of the Radius and Ulna together upon the humerus are those of *flexion* and *extension*.—The muscles may, therefore, be divided into—*a.* Flexors, and *b.* Extensors.

a. Flexors.

1. Biceps.
2. Brachialis internus, assisted by the supinator longus, pronator teres, and flexors of the hand, which arise from the os humeri.

b. **Extensors.**

1. Triceps.
2. Anconeus.

The Motions of the Radius upon the ulna, by which the palm of the hand is turned forwards, or made supine, or turned backwards, or rendered prone, are called *supination* and *pronation;* and the muscles concerned in these motions are, therefore, divided into—*a.* Supinators, and *b.* Pronators.

a. **Supinators.**

1. Biceps.
2. Supinator brevis.
3. Extensor ossis metacarpi pollicis.
4. Extensor primi internodii pollicis.
5. Supinator longus.

N. B.—This last muscle is perhaps not so properly named *Supinator;* as it appears rather calculated to bring the radius to a mid-state between pronation and supination, and, when in that state, to inflect it upon the humerus.

b. **Pronators.**

1. Pronator teres.
2. Pronator quadratus.
3. Flexor carpi radialis.

The Motions of the Hand upon the fore arm consist of inflexions forward or *flexion:* inflexion backwards, or *extension:* inflexion outward, or *abduction:* inflexion inward, or *adduction.* The muscles, therefore, may be divided into—*a.* Flexors, *b.* Extensors, *c.* Abductors, *d.* Adductors.

a. **Flexors.**

1. Flexor carpi radialis.
2. Flexor carpi ulnaris.
3. Palmaris longus.
4. Flexor digitorum sublimis.
5. Flexor digitorum profundis.
6. Flexor longus pollicis.

b. EXTENSORS.

1. Extensor carpi radialis longior.
2. Extensor carpi radialis brevior.
3. Extensor secundi internodii pollicis.
4. Indicator.
5. Extensor communis digitorum.

c. ABDUCTORS.

1. Extensor ossis metacarpi pollicis.
2. Extensor primi internodii pollicis.
3. Extensor carpi radialis longior.
4. Extensor carpi radialis brevior.
5. Flexor carpi radialis.

d. ADDUCTORS.

1. Extensor carpi ulnaris.
2. Extensor communis digitorum.
3. Flexor carpi ulnaris.
4. Flexor digitorum sublimus.
5. Flexor digitorum profundus.

THE MOTIONS OF THE THUMB are those of *flexion—extension—abduction—adduction*. These muscles, therefore, are likewise divided into—*a.* FLEXORS, *b.* EXTENSORS, *c.* ABDUCTORS, *d.* ADDUCTORS.

a. FLEXORS.

1. Flexor longus.
2. Flexor brevis.
3. Flexor ossis metacarpi.

b. EXTENSORS.

1. Extensor ossis metacarpi.
2. Extensor primi internodii.
3. Extensor secundi internodii.

c. ABDUCTORS.

1. Abductor pollicis.
2. Extensor ossis metacarpi.

d. ADDUCTORS.

1. Adductor pollicis.

The MOTIONS OF THE FINGERS, in like manner, are those of *flexion—extension—abduction—adduction;* and the muscles are therefore divided into—*a.* FLEXORS, *b.* EXTENSORS, *c.* ABDUCTORS, *d.* ADDUCTORS.

a. FLEXORS.

1. Flexor digitorum sublimis.
2. Flexor digitorum profundus.
3. Lumbricales.
4. Flexor minimi digiti.

b. EXTENSORS.

1. Extensor communis digitorum.
2. Indicator (extensor of the fore finger.)
3. Interossei.

c. ABDUCTORS.

1. Abductor indicis.
2. Abductor minimi digiti.
3. Interossei:
    - Prior indicis.
    - Prior annularis.
    - Interosseus auricularis.
    - Prior medii digiti.

d. ADDUCTORS.

1. Adductor metacarpi minimi digiti.
2. Interossei:
    - Posterior indicis.
    - Posterior medii digiti.
    - Posterior annularis.

CHAPTER II.

Of the Joints of the Upper Extremity.

The parts connected with the joints should be dissected after the muscles. If the soft parts surrounding them have become dry, it will be necessary to macerate them in water until the examination can be prosecuted with facility. During the dissection it will be right not only to observe the number, strength, and disposition of the ligaments, but to pay attention also to the form and position of the cartilages and ligamento-cartilaginous substances connected with the joints; so that by connecting together all the circumstances of structure, as they regard the bones, cartilages, and ligaments, a knowledge will be acquired of the mechanism, upon which the strength and the kind and extent of the motions in joints depend, and thus the mind may be led to contemplate the nature and treatment of the accidents to which they are liable. Consistently with the prescribed limits of this work, those circumstances only which regard structure can be explained; but an attention is recommended to the other and more practical points above stated, during the inspection of the parts. The joints of the upper extremity are,—1. Those of the bones of the shoulder, including that of the sternal extremity of the clavicle with the trunk, and that of the scapular extremity with the scapula. 2. Shoulder joint. 3. Elbow joint. 4. Those of the radius and ulna. 5. Wrist joint. 6. Joints of the hand.

§ 1. ARTICULATIONS OF THE BONES OF THE SHOULDER.

a. Of the Sterno Clavicular Articulation.

The sternal extremity of the clavicle is received into a depression of the uppermost bone of the sternum, with which it is connected by a capsular ligament; and it is attached also by ligament to the clavicle of the opposite side, and to the first rib. The parts which form the articulation are situated superficially so that its situation, form, and motion

are in a great degree manifest before the integuments have been removed.

1. Interclavicular Ligament. *Ligamentum interclaviculare.* Is formed of transverse fibres, and extends from the one clavicle to the other; in its course being attached to the upper bone of the sternum, above which it rises in the form of a thin edge. It connects, therefore, the two clavicles with each other, and with the sternum, and prevents the former from being carried too far backwards.

2. Claviculo Costal, or Rhomboid Ligament. *Ligamentum rhomboideum.* Named from its connection or from its figure. It is attached above to the rhomboid process at the under and fore part of the clavicle, and below to the cartilage of the first rib. It fixes the clavicle, and moderates its motions.

3. Capsular Ligament. *Ligamentum capsulare.* Is formed by fibres which are distinct, more especially on the anterior and posterior parts, and are attached to the bones about the articulating surfaces: those before are the strongest; those behind, from their direction, have been called the *radiated* ligament. Contained within the capsular ligament is

The Interarticular Cartilage. It is found between the articulating surfaces, and divides the joint into two cavities. It is thin in the centre, being hollowed out in both surfaces, and thick at the circumference, where it is ~~un~~connected with the sternum and the capsular ligament.

The Synovial Membrane. Forms two capsules which correspond to the divisions of this joint by the interarticular cartilage.

b. Of the Claviculo Scapular Articulation.

The connection of the clavicle to the acromion of the scapula is by means of three ligaments. This articulation, like the former, is situated so superficially, as to admit readily of examination beneath its common coverings.

1. Capsular Ligament. *Ligamentum capsulare.* Is attached to the bones near the articular surfaces. It is short, and strengthened by strong transverse fibres on tho exterior, more especially at the upper part.

Within this capsule is sometimes found a small *interarticular cartilage.*

The other two ligaments pass from the clavicle to the coracoid process; they are intimately connected with each other, and are only distinguished by the different direction of their fibres, viz.

2. INTERNAL CORACO CLAVICULAR, or CONOID LIGAMENT, *Ligamentum conoideum*, which passes from the root of the coracoid process, and is fixed to the tubercle, on the posterior edge of the clavicle.

3. EXTERNAL CORACO CLAVICULAR, or TRAPEZOID LIGAMENT, *Ligamentum trapezoideum*, which is situated exterior to the former. It extends from about the middle of the convexity of the coracoid process, passes more transversely, and is attached farther out to the under surface of the scapular extremity of the clavicle.

c. PROPER LIGAMENTS OF THE SCAPULA.

Of these there are five, viz.:—

1. ANTERIOR, or TRIANGULAR LIGAMENT. *Ligamentum anterius triquetrum, coraco-acromiale.* Is broad, flattened, and of a triangular figure. Its broad extremity is attached to the convexity of the coracoid process; it becomes gradually narrower, and is fixed to the posterior edge of the acromion. It is sometimes formed by two separate bundles united by a membranous substance. From its edge a layer of dense cellular membrane extends, under the deltoid muscle, and projects over the shoulder joint. It thus assists in preventing a displacement of the os humeri upwards.

2. POSTERIOR LIGAMENT. *Ligamentum scapulæ proprium posterius, minus.* Is stretched across the semilunar notch, from the superior costa to the root of the coracoid process of the scapula, and forms that depression into a passage for the superior dorsal vessels and nerve of the scapula.

3. ACROMIO GLENOID LIGAMENT. Is a band extending from the root of the acromion to the edge of the glenoid cavity.

4. CORACO GLENOID. Originates from the root of the coracoid process, and attached to the edge of the glenoid cavity.

5. GLENOID LIGAMENT. *Ligamentum glenoideum.* Is a projecting ring of ligamento-cartilaginous substance, which is attached to the circumference of the glenoid cavity, and thereby renders it deeper.

§ 2. OF THE SHOULDER JOINT.

The shoulder joint, consisting of the glenoid cavity of the scapula, and the head of the os humeri, is surrounded by thick and strong muscles, which more especially contribute to give figure to this joint externally; of these the deltoid is the principal, which covers the articulation, and gives, in a muscular person, a well marked rotundity to the shoulder. From this circumstance, deformity in consequence of accident is not so easily detected, and the parts which form the articulation cannot be readily handled, so as to determine the nature and degree of any injury which may have occurred. The parts about the articulation, which may be felt when surrounded by the soft parts, are the acromion, and less distinctly, the coracoid process of the scapula, and the head of the os humeri. The ligaments belonging to the shoulder joint are two, the capsular and the glenoid, but the tendon of the long head of the biceps answers somewhat the purpose of a ligament, in restraining the motions of the head of the os humeri, like the round ligament in the hip joint.

1. Capsular Ligament. Is in the form of a loose bag, which is attached above to the circumference of the glenoid cavity, and below to the neck of the os humeri, and encloses the head of that bone. It is made up of fibres, closely interwoven with each other. It is strongest above, and thinnest on the inner side. It is strengthened above by the tendon of the supra-spinatus, and behind by those of the infra-spinatus, and teres minor muscles. At the under and fore part, at its edge, is a small aperture for the passage of the tendon of the long head of the biceps, and the capsular ligament sends off a process to enclose the tendon in its descent.

2. Glenoid Ligament. Already described.

The Synovial Membrane lines the capsular ligament, and is continued upon the articular surfaces of the scapula and os humeri. A process is extended into the groove for the tendon of the biceps, which is then reflected upwards round the tendon.

Practical Points. *Fractures* connected with this joint:—of the acromion—of the neck of the scapula—of the neck of the os humeri.

Dislocations:—Of the os humeri into the axilla—under the clavicle—on to the dorsum of the scapula.

§ 3. OF THE ELBOW-JOINT.

The bones which enter into the composition of this joint, are the os humeri, the radius, and the ulna; and the parts of these bones connected with the joint are:—Of the os humeri, the two condyles, the double articular surface, and the anterior and posterior depressions: of the ulna, the olechranon, the coronoid process, and the greater sigmoid cavity: of the radius, the head. These articular surfaces are covered with cartilage.

The external form of the joint is determined in a great measure by the muscles which surround it, viz. the flexors of the fore arm anteriorly; the flexors of the hand and fingers, and the pronator below and before the inner condyle; and the extensors of the hand and fingers, and supinators about the outer condyle. These muscles conceal much of the articulation, and thereby often render the detection of the kind of injury, which may have occurred at this joint, difficult. The parts which may be felt are:—the olechranon, which is sub-cutaneous, and the inner condyle, and, less distinctly, the outer condyle between the extensors of the hand and fingers. The coronoid process is distinguished with difficulty in the depression at the upper part of the fore arm, between the flexors and extensors.

Four ligaments connect the bones of the upper end of the fore arm, viz.:—

1. Brachio Cubital, or Internal Lateral Ligament. *Ligamentum cubiti laterale internum.* Is fixed above to the fore part of the inner condyle of the os humeri, then descends spreading upon the inner side of the synovial capsule, and is attached below to the inner side of the coronoid process of the ulna.

2. Brachio Radial, or External Lateral Ligament. *Ligamentum cubiti laterale externum.* Resembles the former, and is stretched between the fore part of the outer condyle of the os humeri above, and the coronary ligament which surrounds the neck of the radius below.

3 & 4. Anterior and Posterior Ligaments. *Ligamenta cubiti anterius et posterius.* Are broader, but thinner than the lateral ligaments, and consist of fibres which are spread irregularly upon the fore and back parts of its synovial capsule. By some, these are considered a single ligament, and called the *Capsular.*

The Synovial Membrane extends from the articular surfaces of the os humeri; before from above the anterior depression, and behind from above the posterior depression, to the articular surfaces of the radius and ulna. The portion attached to the radius descends as far as the neck, so that the head is loosely surrounded by the synovial capsule. On the ulna it is extended to the greater and less sigmoid cavities. The synovial capsule is looser before and behind than at the sides. In the posterior depression of the os humeri, and at other parts of the joint, a quantity of fatty matter is found.

Practical Points. *Fractures:*—Of the condyles of the os humeri—of the olechranon.

Dislocations:—Of the radius and ulna forwards, or before the condyles of the os humeri—of the radius and ulna to the inner or outer side (partially)—of the radius and ulna backwards—of the radius only—of the extremity of the os humeri between the radius and ulna.*

§ 4. ARTICULATIONS OF THE RADIUS AND ULNA.

The head of the radius is received into the less sigmoid cavity of the ulna above; and the extremity of the ulna is received in a depression of the radius below. The surfaces in contact are covered by cartilage, so as to admit of motion, and ligaments are found at these parts for the purpose of moderating such motion. There is besides a broad ligamentous expansion filling up the space between the two bones.

There are four ligaments between the two bones, viz.:—

1. Coronary, or Annular Ligament. *Ligamentum radii annulare.* It is extremely firm and strong, and is composed of transverse, circular fibres. It arises from the fore part of the small sigmoid depression of the ulna, and after surrounding the neck of the radius, is fixed to the opposite extremity of that cavity. It is intermixed with fibres of the anterior and posterior, and of the external lateral ligaments above, but is terminated by an edge below.

2. Oblique Ligament. *Ligamentum cubiti obliquum, membrana transversa.* Is attached above to the tubercle of the ulna. It extends obliquely downwards to the radius, and is fixed to the lower part of the tubercle of that bone.

3. Interosseous Ligament. Connects the radius and ulna through the greater part of their length, and

is extended between the sharp ridges of these bones. It is broadest in the middle, and is composed of fibres, which run obliquely downwards and inwards. At different parts there are openings for the passage of vessels; the most remarkable of which are above and below.

4. Sacciform Capsule. *Ligamentum sacciforme, membrana capsularis sacciformis.* The under extremity of the ulna is attached to the radius by a synovial capsule, which surrounds the articular surfaces of both bones, and is strengthened on the exterior by ligamentous fibres.

§ 5. OF THE WRIST-JOINT, OR ARTICULATION OF THE BONES OF THE FORE ARM WITH THOSE OF THE CARPUS.

The bones which are here articulated with each other, are the radius and ulna, with the three first bones of the upper row of the carpus, viz. the scaphoid, lunar, and cuneiform. They are connected by means of four ligaments; but the extremity of the ulna does not form a part of the joint, owing to the intervention of an interarticular cartilage. The parts of this joint, being surrounded only by tendons, are superficial, and admit, therefore, readily of examination: the parts which are the most prominent, are the styloid processes of the radius and ulna.

1 & 2. Anterior and Posterior Ligaments. *Ligamenta cubito-carpalia, palmare et dorsale.* Are formed of strong fasciculi of oblique and perpendicular fibres. They are attached above to the margin of the articular surface of the radius, styloid process of the ulna, and interarticular cartilage, and are fixed below to the three first bones of the carpus.

3. Cubito Carpal, or Inner Lateral Ligament. *Ligamentum cubitale.* Is attached above to the styloid process of the ulna, is connected with the posterior ligament, and is fixed below to the posterior surface of the cuneiform, and to the pisiform bones.

4. Radio Carpal, or Outer Lateral Ligament. *Ligamentum radiale.* Is attached above to the styloid process of the radius, and below to the scaphoid bone.

The Interarticular Cartilage. Is placed between the extremity of the ulna and the cuneiform bone. It is firmly connected with the cartilage covering the end of

the radius, and is loosely attached to the styloid process of the ulna. It is hollowed above and below. The synovial membrane of the wrist joint is attached to its under surface, and the sacciform ligament to its upper surface; so that the extremity of the ulna and superior surface of the cartilage are excluded from the wrist joint, but communicate with the articulation between the under extremities of the radius and ulna. The proper joint of the wrist is therefore formed by the articular surface of the radius and the inferior surface of the interarticular cartilage above, and the articular surfaces of the scaphoid, lunar, and cuneiform bones below.

The SYNOVIAL MEMBRANE, or capsule of this joint, is connected with the articular surfaces, and lines the ligaments which surround the joint.

PRACTICAL POINTS.—*Dislocations* of the carpus;—backwards—forwards. *Amputation* at the wrist joint.

§ 6. ARTICULATIONS OF THE HAND.

a. ARTICULATIONS BETWEEN THE CARPAL BONES.—The bones of the first and second row of the carpus are connected by ligaments, which resemble those of the wrist joint.

1. ANTERIOR AND POSTERIOR LIGAMENTS. Are attached to the three first bones of the uppermost row, and are fixed below to the four bones of the second row. They consist of bundles of fibres, which take different directions.

2. LATERAL LIGAMENTS. Situated on the inner and outer side. The outer is extended between the scaphoides and trapezium; the inner, between the cuneiform and unciform bones.

3. ARTICULATION OF THE OS PISIFORME. Is by means of a separate *synovial membrane;* and it is further connected by short *ligamentous fibres* to the os unciforme.

4. ACCESSORY LIGAMENTS. Besides the ligaments above described, there are various *ligamentous slips,* extending in different directions, both on the palmar and dorsal side, which assist in connecting these bones.

The SYNOVIAL MEMBRANE extends from the three first bones of the upper row to the four of the lower row, sends off processes between them, and is continued to the articulations of the metacarpal bones.

b. ARTICULATIONS BETWEEN THE CARPAL AND METACARPAL BONES.

These ligaments consist of slips, which run in various directions between the bones, and are strongest on the dorsal surface. They are so short as only to allow of a slight yielding motion.

The ligamentous fibres of the first metacarpal bone are longer and stronger, extending from the trapezium upon it; and to this joint there is a peculiar synovial membrane.

c. ARTICULATIONS BETWEEN THE METACARPAL BONES. The four metacarpal bones, which support the fingers, have smooth articular surfaces at their posterior extremities, where they are in contact with each other, and processes of the common synovial membrane of the carpus are generally extended to them. The ligaments of these bones are three, viz. :—

1 & 2. ANTERIOR AND POSTERIOR. Situated at the posterior extremity, consisting of transverse fibres.

3. ANTERIOR, or INTEROSSEOUS. Situated at the anterior extremities or heads. They consist of transverse fibres, which are much stronger than the former, but are longer; and allow, therefore, of more motion. They are placed on the palmar side of the hand, and connect the heads of the four metacarpal bones of the fingers to each other.

d. ARTICULATIONS OF THE METACARPAL BONES AND FINGERS, OF THE BONES OF THE PHALANGES, AND OF THE BONES OF THE THUMB.

The capsules and ligaments of these joints do not differ from each other. They consist of *capsules*, formed by synovial membrane, which enclose the articular surfaces; and *lateral ligaments*, situated at the sides of the joints, which adhere to and strengthen them.

PRACTICAL POINTS.—*Dislocations* of the thumb. *Amputation* of the fingers; which requires a knowledge of the actual situation of the joint connected with external appearance.

CHAPTER III.

Of the Muscles of the Lower Extremity.

It is unnecessary to repeat here the observations with which the dissection of the Upper Extremity was introduced. They may, however, be easily referred to, Chap. I. of this section, should the Lower Extremity be dissected first.

The muscles of the Lower Extremity are distributed into Regions about the Pelvis, on the Thigh, the Leg, and the Foot.

§ 1. REGIONS ABOUT THE PELVIS.

Of these the Lumbar and Pelvic, which are contained within the abdominal and pelvic cavities, cannot be dissected till the abdominal muscles and viscera have been removed: and if that be not done, it will be more convenient to begin with the dissection of the regions on the thigh, (see p. 112,) and afterwards continue with those of the pelvis as soon as opportunity will allow.

a. Lumbar, containing ~~three~~ four muscles.

1. M. Quadratus Lumborum.

Situation. Between the last rib, the crista of the ilium, and the vertebræ, and behind the kidney.

Origin. Broad tendinous and fleshy, from the posterior part of the spine of the os ilii.

Insertion. Into the transverse processes of all the lumbar vertebræ, into the last rib near the spine, and by a small tendon into the side of the last dorsal vertebra.

Use. To move the loins to one side; to pull down the last rib; and when both muscles act, to bend the loins forwards.

2. M. Psoas Magnus.

Situation. Close to the sides of the lumbar vertebræ, and extending along the brim of the pelvis: it is a considerable muscle.

Origin. By distinct slips from the side of the body, and from the transverse process of the last dorsal vertebra, and in the same manner from the bodies and transverse processes of all the lumbar vertebræ. These unite to form a rounded fleshy belly, which descends before the inner part of the iliacus, then over the junction of the os pubis and ilium, and terminates in a strong tendon.

Insertion. Tendinous and fleshy into the trochanter minor and body of the os femoris, a little below that process.

Use. To bend the thigh forwards on the belly, and to rotate it outwards; or if the thigh be fixed, to bend the body forwards upon the lower extremities.

3. M. PSOAS PARVUS.

Situation. Upon the last muscle: it is small, and often wanting.

Origin. Fleshy from the side of the bodies of the two uppermost lumbar vertebræ, and sometimes from the last dorsal vertebra. It sends off a long slender tendon, which descends upon the inner side of the psoas magnus: from which an aponeurosis extends upon the adjacent muscles.

Insertion. Into the brim of the pelvis, at the junction of the os pubis and ilium.

Use. To assist in bending the loins forwards, or in bending the pelvis upon the loins.

4. M. ILIACUS.

Situation. Filling up the venter of the ilium, and hence is sometimes called *iliacus internus.*

Origin. Tendinous and fleshy from the transverse process of the last lumbar vertebra, from the inner labium of the spine of the ilium, and from the edge of the bone, as far as the anterior and inferior spinous process; likewise fleshy from the hollow of the ilium, which it fills up, and from the aponeurosis, which covers it. The fibres converge as they descend, and join with the psoas magnus, where it becomes tendinous.

Insertion. With the psoas magnus.

Use. To bend the thigh forwards on the belly, and rotate it outwards; or to bend the pelvis forwards on the thigh.

Between the common tendon of the psoas magnus and iliacus and the capsular ligament of the hip joint, is situated a considerable *bursa mucosa;* and a smaller one between it and the trochanter minor.

b. PELVIC, containing two muscles.

1. M. Obturator Internus.

Situation. On the inside of the obturator foramen, within the pelvis, covered by the levator ani.

Origin. From more than half of the internal surface of the circumference of the obturator foramen, formed by the os pubis and ischium. The muscle consists of radiated fasciculi of fibres, which pass down and converge towards a strong tendon, and are covered by an aponeurosis: the tendon, surrounded by muscular fibres, passes out of the pelvis over the smooth surface between the spinous process and tuberosity of the ischium, through the lesser sacro-sciatic foramen.

Insertion. By a strong tendon into the middle part of the cavity at the root of the trochanter major.

Use. To roll the thigh obliquely outwards.

Observe, this muscle should not be displayed till the muscles of the ischiadic region have been dissected.

Between the tendon of this muscle, the gemini and the trochanter major is placed a *bursa mucosa;* and another *bursa* between the spinous process and tuberosity of the ischium.

2. M. Coccygeus.

Situation. Spread upon the front of the sacro-ischiatic ligaments.

Origin. Tendinous and fleshy from the spinous process of the ischium, covers the sacro-sciatic ligament, upon which it spreads in its course.

Insertion. Into the extremity of the sacrum and side of the os coccygis.

Use. To raise the os coccygis, and to strengthen its connection with the other parts of the pelvis.

c. Gluteal, containing three muscles, which form the nates.

1. M. Gluteus Maximus.

Situation. On the lower and back part of the nates, giving their rounded form. It is a large muscle, covering the posterior third of the dorsum ilii, and is to be dissected by making an incision from about two inches before the superior posterior spinous process of the ilium, and extending it to the upper and back part of the trochanter major, and following the course of its fibres in that direction.

Origin. Tendinous and fleshy from the posterior part of the outer labium of the spine of the ilium, from the under part of the external surface of the os sacrum, from the posterior sacro-sciatic ligament, over which part of the lower edge of this muscle is folded, and from the os coccygis. The fleshy fibres run obliquely downwards and forwards, forming a thick and broad muscle, which is composed of coarse and loosely connected fasciculi, intermixed with and covered by a considerable quantity of adipose membrane. The upper part of it covers the trochanter major, and it is connected with the tendinous expansion which covers the thigh.

Insertion. By a strong, thick, and broad tendon into the upper and outer part of the linea aspera, extending from the trochanter major for some way downwards, and into the fascia of the thigh.

Use. To extend the thigh backwards, and to rotate it outwards.

Several *bursæ mucosæ* are situated on the internal surface of the tendon of this muscle. The most considerable is found between it and the external surface of the trochanter major. A considerable, but smaller one, is placed between its broad tendinous expansion and the upper part of the vastus externus, and two smaller ones commonly between the muscle and the os femoris, at the upper and back part of the thigh.

2. M. Gluteus Medius.

Situation. Upon the dorsum ilii, immediately under the common integuments, on the two anterior thirds of the dorsum, where it is covered by a strong fascia; and behind by part of the origin of the gluteus max. which must be turned back.

Origin. Fleshy from the anterior and superior spinous process externally, from a large share of the outer lip of the ilium, and posteriorly from the dorsum of the bone. The fore and upper part of the muscle is covered by a continuation of the fascia of the thigh, from which it receives numerous fleshy fibres,

Insertion. By a strong short tendon into the outer and back part of the trochanter major.

Use. To extend the thigh outwards and slightly backwards.

A *bursa* is placed between this muscle and the upper part of the trochanter major.

3. M. Gluteus Minimus.

Situation. On the dorsum ilii, and covered by the last muscle, which should be raised from the under and back part of its origin, to expose it: this should be done cautiously, without raising with it the pyriformis muscle.

Origin. Fleshy from a semilunar ridge, which is continued from the anterior and superior spinous process of the

ilium, across the dorsum of the bone as far as its notch, and from the dorsum of the ilium below.

Insertion. By a strong short tendon into the fore and upper part of the trochanter major.

Use. It abducts and rotates the thigh inwards; but if parts of the fibres act, the anterior flex the thigh on the belly, the posterior rotate it outwards.

A small *bursa* is situated between it and the trochanter major anteriorly.

d. ISCHIADIC, containing three muscles, which are exposed by removing the M. glutei.

1. M. PYRIFORMIS.

Situation. Immediately below the M. gluteus min., and seen coming out of the greater sacro ischiatic hole.

Origin. Within the pelvis, by three tendinous and fleshy origins from the second, third, and fourth pieces of the sacrum. It passes out of the pelvis through the greater sacro-ischiatic foramen, and receives an addition of some fibres from the ilium. It tapers in its descent, and is sometimes divided for the passage of the sciatic nerve.

Insertion. By a rounded tendon into the upper part of the cavity on the inside of the trochanter major.

Use. To rotate the thigh outwards, and to flex it a little upon the belly.

A *bursa* is situated between its tendon and the upper of the gemini muscles.

2. M. GEMINI.

Situation. Are two small muscles situated immediately below the pyriformis, and separated from each other by that part of the obturator internus, which is exterior to the pelvis.

Origin. The superior from the spinous process, and the inferior from the tuberosity of the ischium, and from the posterior sacro-sciatic ligament.

Insertion. Tendinous and fleshy into the cavity on the inside of the trochanter major, firmly adhering on each side to the tendon of the obturator internus, which cannot be seen till the dissection of this region.

Use. To rotate the thigh outwards.

3. M. QUADRATUS FEMORIS.

Situation. Below the gemini, and named from its figure.

Origin. Tendinous and fleshy from the outside of the tuberosity of the ischium. It runs transversely outwards.

Insertion. Fleshy into the linea quadrata, which is extended between the roots of the large and small trochanter. Under its upper edge is situated a portion of the obturator externus.

Use. To rotate the thigh outwards.

Between the muscle and the less trochanter is placed a *bursa.*

§ 2. ON THE THIGH.

Fascia of the Lower Extremity. The greater number of the muscles of the lower extremity are covered by a tendinous expansion or aponeurosis. On the thigh it is called the Fascia Lata, and on the leg the Aponeurosis Cruralis. There is also a tendinous expansion on the sole of the foot, called the Aponeurosis Plantaris.

The *fascia lata* begins from the fore part of the gluteus maximus, from the fore part of the outer labium of the crista of the ilium, and from Poupart's ligament; from these parts it descends over the muscles of the thigh as far as the knee, giving them a general covering. It is thickest on the outside, and thinnest on the inside of the thigh, being in that situation scarcely distinguishable from cellular membrane. Within the fascia several processes are sent towards the thigh bone, to be attached to the linea aspera in such way as to form bags; one of these includes the muscles on the fore part of the thigh, consisting of the extensors of the leg; another on the inside, surrounds the adductors of the thigh and leg; and a third behind encloses the flexors of the leg.

The *aponeurosis of the leg* is continuous with that of the thigh, and then passes down over the muscles of the leg as far as the foot. It is fixed above to the heads of the tibia and fibula, and in its descent to the spine of the tibia. It is most considerable in thickness on the fore and outer part of the leg. Below, the fascia forms at the fore part of the ankle joint the *Ligamentum tranversum tarsi seu Ligamentum cruciatum,* where it is strongest and thickest. This ligament is formed of two decussating bands, one of which passes from the outer malleolus downwards and inwards as far as the metatarsal bone of the great toe, and the other passes from the inner malleolus in the opposite direction to be fixed to the metatarsal bone of the little toe. Below, both are continuous with the thin tendinous expansion which covers the dorsum of the foot.

The tendinous covering of the lower extremity need not be displayed at once; but its different parts may be examined during the prosecution of the dissection of the muscles.

a. OUTER CRURAL, containing one muscle.

M. TENSOR VAGINÆ FEMORIS.

Situation. On the outside of the thigh, immediately below the superior anterior spine of the ilium.

Origin. Tendinous from the anterior and superior spinous process of the ilium externally, extends downwards and backwards.

Insertion. A little below the trochanter major into the inside of the fascia lata.

Use. To render the fascia tense, and to assist in the abduction of the thigh and its rotation inwards.

After dissecting this muscle the fascia lata may be removed to display the

b. ANTERIOR CRURAL, containing five muscles.

1. M. SARTORIUS.

Situation. Superficial; it is a thin flat muscle which passes inwards and downwards across the thigh.

Origin. Tendinous from the anterior and superior spinous process of the ilium. It passes at first over the tendon of the rectus, goes inwards and downward over the adductor longus and magnus, and descends below on the inner side of the thigh. In the middle third of the thigh it covers the femoral vessels: a knowledge of its relative situation is therefore extremely important, and in dissecting it the attachments to the parts beneath should be left untouched.

Insertion. By a broad thin tendon, which is expanded on the inner surface of the tibia near the lower part of its tubercle.

Use. To bend the leg obliquely inwards, or to bring it across the other.

The principal vessels of the lower extremity take their course for some way on the anterior part of the thigh; they then descend along the inner part of the thigh, covered by the sartorius muscle, and passing backwards are situated in the ham. At the lower edge of the popliteus muscle, they divide; one set is placed on the anterior part of the leg near to, and on, the outer side of the tibia; while those, placed posteriorly, take the course of each side of the leg, pass close by the tibia and fibula, and terminate ultimately in the toes.

2. M. RECTUS.

Situation. In front of the thigh, and to the outside of the upper part of the sartorius.

Origin. Tendinous by two strong attachments; the one from the anterior and inferior spinous process of the ilium, and the other from the dorsum of the same bone, a little above the acetabulum. They form by their union a single strong tendon, which descends down the middle of the fore part of the thigh, forming a strong double penniform muscle, which terminates below in a strong flat tendon.

Insertion. Tendinous into the base of the patella.

Use. To flex the thigh on the belly, and at the same time to extend the leg.

3. M. VASTUS EXTERNUS.

Situation. On the outside of the thigh; it is the strongest extensor of the leg.

Origin. Broad tendinous and fleshy from the fore and outer part of the root of the trochanter major, and from the outer side of the greater part of the linea aspera. The fibres run obliquely downwards and forwards.

Insertion. Tendinous into the outer and upper part of the patella, and connected with the tendon of the rectus.

Use. To extend the leg upon the thigh.

4. M. VASTUS INTERNUS.

Situation. Smaller than the former, on the inner side of the os femoris.

Origin. Tendinous and fleshy from the fore and upper part of the os femoris, extending as high as the rough line between the trochanter major and minor, and from the upper part of the inside of the linea aspera. Its fibres pass obliquely downwards and forwards. It is connected below with the tendon of the rectus.

Insertion. Tendinous into the inner and upper part of the patella.

Use. Same as the last.

5. M. CRURALIS.

Situation. On the front of the thigh, between the M. vasti, and covered by the M. rectus, which should be turned aside.

Origin. Fleshy below the former muscle, from the larger part of the anterior and external surface of the os femoris. The larger part of this muscle is covered by the vasti, and is intimately connected with both those muscles.

Insertion. Into the upper part of the patella, behind the rectus.

Use. To extend the leg.

Between the tendons of this muscle, that of the vastus externus, the capsule of the knee joint, and the patella, is situated a *bursa mucosa,* which frequently opens into the joint.

c. INNER CRURAL, containing six muscles.

1. M. PECTINEUS, *Pectinalis.*

Situation. Immediately below the body of the os pubis, and covered partially by the sheath containing the femoral vessels.

Origin. Broad, thin, and fleshy, from the fore part of the body of the os pubis, above the obturator foramen, and passes somewhat obliquely downwards.

Insertion. By a flat, short tendon into the fore and upper part of the linea aspera.

Use. To bring the thigh upwards and inwards, and rotate it outwards.

2. M. GRACILIS.

Situation. On the inside of the whole length of the thigh.

Origin. By a thin tendon from the os pubis, near to the symphysis. It forms a slender, flat muscle, which descends on the inner side of the thigh.

Insertion. Tendinous, into the inner and upper part of the tibia, below and behind the sartorius.

Use. To draw the thigh inwards across the other.

M. TRICEPS ADDUCTOR FEMORIS. Under this term are often comprehended three muscles in this region, which are found on the inside of the thigh, behind the pectineus above, and the vastus internus below, and more properly distinguished as

3. M. ADDUCTOR LONGUS FEMORIS.

Situation. Most anterior of the three.

Origin. By a strong round tendon from the upper and fore part of the os pubis, and from the fore part of the symphysis of that bone, passes obliquely downwards and outwards, and spreads in its descent.

Insertion. Tendinous into the back part of the linea aspera, about its middle, and is continued some way down.

4. M. ADDUCTOR BREVIS FEMORIS.

Situation. ~~Above and~~ behind the former.

Origin. By a short tendon, immediately below and behind the former, from the fore part of the os pubis, near the symphysis pubis. It passes downwards and outwards.

Insertion. Tendinous into the back part of the root of the trochanter minor, and into the upper third of the linea aspera. It is connected, more or less, with the pectineus and the adductor magnus.

5. M. ADDUCTOR MAGNUS FEMORIS.

Situation. Behind the two last muscles; it is the largest of the three, and extends along the whole of the inside of the thigh.

Origin. Tendinous and fleshy, lower than the former from the ramus of the os pubis, and from the ramus and tuberosity of the ischium. Its fibres pass with different degrees of obliquity outwards and downwards.

Insertion. Behind the pectineus, and the other adductors, into the whole length of the inner edge of the linea aspera, into the ridge which extends from it to the inner condyle of the os femoris, and by a roundish tendon into the same condyle. Its tendon has a hole in it for the passage of the femoral vessels to the ham.

Use. These three muscles have the same use, viz. to bring the thigh inwards and upwards; and to roll it in a slight degree outwards.

6. M. OBTURATOR EXTERNUS.

Situation. On the front of the obturator hole: it cannot be seen distinctly till the M. pectineus and triceps be cut away.

Origin. From the os pubis and ischium, where forming the circumference of the obturator foramen, and from the ligamentous expansion which occupies that opening. The fibres converge and pass outwards behind the cervix of the os femoris, where they are covered by the M. quadratus femoris.

Insertion. By a strong tendon, into the cavity at the root of the trochanter major.

Use. To roll the thigh outwards obliquely.

d. POSTERIOR CRURAL, containing three muscles.

1. M. SEMI-TENDINOSUS.

Situation. On the inner and back part of the thigh: it is named from an oblique tendinous intersection in its fleshy part.

Origin. By a tendon which is united with that of the long head of the biceps flexor cruris, from the posterior part of the tuberosity of the ischium; it terminates in a long, roundish tendon.

Insertion. Into the upper part of the inner surface of the tibia, immediately below the graçilis, its tendon spreading at that part.

Use. To extend the thigh on the pelvis, and at the same time to bend the leg backwards and a little inwards.

X through a groove between the lower edge of the acetabulum & the upper end of the tuberosity of the ischium

Between the upper tendon of this muscle, that of the semimembranosus, and the long head of the biceps, is placed a *bursa*. A second *bursa*, or sometimes more than one, is situated between the under tendon of this muscle, the tendon of the gracilis, and the internal lateral ligament of the knee joint.

3. M. Semi-membranosus.

Situation. On the inner and back part of the thigh, and covered partially by M. semi-tendinosus; although called semimembranosus, it is remarkable from being in a considerable part composed of tendon, its fleshy belly passing between a strong, oblique, tendinous portion at the upper and under part.

Origin. By a strong broad tendon, beneath the former, from the upper and back part of the tuberosity of the ischium, immediately below the origin of the inferior head of the M. gemini.

Insertion. By a strong tendon into the inner and back part of the head of the tibia.

Use. To extend the thigh on the pelvis, and bend the leg directly back upon the thigh.

A *bursa* is situated between its upper tendon and the quadratus femoris. Another *bursa* is found between its under tendon, the inner head of the gastrocnemius, and the capsule of the knee.

2. M. Biceps Flexor Cruris.

Origin. By two heads. The long head arises between the two former muscles from the back part of the tuberosity of the ischium, by a short, but strong tendon. The short head arises from the linea aspera, a little below the insertion of the gluteus maximus, by a sharp, fleshy attachment. The fleshy bellies of the two heads unite, and are attached below to a strong tendon.

Insertion. Tendinous, into the upper part of the head of the fibula.

Use. To extend the thigh upon the pelvis, and to bend the leg.

A *bursa* is found between the lower tendon of this muscle and the external lateral ligament of the knee.

The flexors of the leg above described, diverge above and behind the knee; the semitendinosus and semimembranosus passing down on the inner side, and the biceps flexor cruris on the outer side, thus leave a space, occupied by cellular membrane, through which the popliteal vessels pass. The projections, which they form, may be distinguished before the integuments have been removed: they are termed the HAM-STRINGS, of which the *inner* is formed by the semitendinosus and semimembranosus, and the *outer* by the biceps.

§ 3. ON THE LEG.

The *aponeurosis*, which has been already described, is to be attended to in the dissection. The regions into which the muscles are distributed, are:

a. The ANTERIOR TIBIAL, containing three muscles.

1. M. TIBIALIS ANTICUS.

Situation. Close to the tibia; it is the strongest of the anterior muscles.

Origin. Tendinous and fleshy, from the under and outer part of the head of the tibia, close to the peroneus longus. It continues to arise from about three fourths of the outer surface of the tibia, along which it passes down the leg, from a large share of the interosseous ligament, and from the aponeurosis of the leg above. Its fibres pass obliquely to a strong, round tendon, which passes off from it below, and is continued over the fore part of the extremity of the tibia, and behind the transverse ligament of the ankle, to the inner side of the foot.

Insertion. Into the inside of the os cuneiforme internum, and base of the metatarsal bone supporting the great toe; its tendon being enclosed in a *sheath* of synovial membrane.

Use. To bend the foot upwards and inwards.

2. M. EXTENSOR LONGUS COMMUNIS DIGITORUM.

Situation. On the outer side of the former muscle.

Origin. Tendinous and fleshy from the outer part of the head of the tibia, from the head and anterior edge of the fibula, and from the interosseous ligament, and above from the aponeurosis of the leg. Its fibres pass obliquely downwards and forwards to a tendon which runs along its anterior edge. The tendon is continued behind the transverse ligament of the ankle, and near that part divides into five slips.

Insertion. The outermost and shortest of these is attached to the base of the metatarsal bone of the little toe; the fleshy fibres which belong to this tendon are sometimes separated from the common extensor, and form a muscle which has been called the M. *Peroneus tertius.* The four other tendinous slips are expanded over the upper surface of the phalanges of the

four smaller toes, to which they are attached. These tendons should be traced to their termination.

Use. To extend all the joints of the four smaller toes, and to bend the foot upon the leg: the slip called Peroneus tertius assists in turning the foot outwards.

A *bursa* is situated between the tendon of this muscle and the capsule of the ankle joint.

3. M. EXTENSOR LONGUS PROPRIUS POLLICIS.

Situation. Between the two former muscles, at the lower part of the leg.

Origin. Tendinous and fleshy from the inner part of the fibula, beginning some way below the head, and continued to near its extremity, and from the interosseous ligament. Its fibres pass obliquely to a tendon which runs along its anterior edge, and is continued in a separate passage behind the transverse ligament of the ankle, and runs on the inner side of the foot.

Insertion. Into the second bone of the great toe.

Use. To extend the great toe, and to assist in flexing the foot upon the leg.

The tendon of this muscle is included on the dorsum of the foot in a *sheath* of synovial membrane.

b. SUPERFICIAL POSTERIOR TIBIAL, containing three muscles.

1. GASTROCNEMIUS EXTERNUS. *Gemellus.*

Situation. On the back of the leg; it is a muscle of considerable size and strength, being that by which the calf of the leg is principally formed.

Origin. By two distinct tendinous heads from the os femoris immediately above the upper and back part of the condyles of that bone. The two heads are narrow above, but become broader and thicker as they descend and unite a little below the knee joint in a middle tendon. The muscle terminates in a thin, broad tendon, which joins below with the tendon of the next muscle.

Insertion. With the gastrocnemius internus.

Use. To extend the foot on the leg.

2. M. GASTROCNEMIUS INTERNUS. *Soleus.*

Situation. Under the former: in order to display it, the gastrocnemius externus must be raised from its origin, and dissected downwards, when the plantaris and popliteus will also be exposed.

Origin. From the posterior surface of the tibia, its attachment being continued obliquely along the under edge of the popliteus, from the upper and back part of the head of the fibula, and from the posterior surface and outer edge of the fibula for some way down. From these attachments it passes down before the gastrocnemius externus, in the form of a thick fleshy belly, which reaches below the fleshy part of the former muscle, and is attached to the common tendon; the exterior being covered by numerous tendinous fibres.

Insertion. With the former muscle by a strong, rounded tendon, called the Tendo Achillis, into the upper and posterior part of the tuberosity of the os calcis.

Use. Same as the last.

A considerable *bursa* is placed between the tendo Achillis and the tuberosity of the os calcis.

3. M. Plantaris.

Situation. Upon the gastrocnemius internus, and covered by the outer head of the gastrocnemius externus.

Origin. Fleshy from the back part of the outer condyle of the os femoris. It has a small fleshy belly, which adheres to the capsule of the joint in its descent, and soon terminates in a long, slender, thin tendon. The tendon passes down between the gastrocnemii, then runs along the inner edge of the tendo Achillis.

Insertion. Into the inner and back of the tuberosity of the os calcis, but is frequently spread in the cellular membrane, about the heel. It is not unfrequently wanting.

Use. To assist the gastrocnemii, and also to rotate the foot slightly inwards.

c. Deep Posterior Tibial, containing four muscles.

1. M. Popliteus.

Situation. At the back part of the knee joint, and covered by the gastrocnemius externus.

Origin. By a round tendon from the under and back part of the outer condyle of the os femoris; it descends over the back part of the joint, forming a broad, thin, triangular, fleshy belly, which adheres to the capsule, is composed of oblique fibres, and is covered by a tendinous expansion.

Insertion. Fleshy, into the upper and inner part of the posterior surface of the tibia.

Use. To bend the leg upon the thigh, and when bent, to rotate it slightly inwards.

Between this muscle, the outer condyle, the outer semilunar cartilage, and the capsule of the joint, is situated a *bursa*, which frequently communicates with the joint.

The gastrocnemius internus should now be removed, in order to expose the origins of the other muscles.

2. M. FLEXOR LONGUS DIGITORUM COMMUNIS. *Profundus perforans.*

Situation. On the back of the tibia; it is a thin penniform muscle.

Origin. Tendinous and fleshy, from more than half of the posterior surface of the tibia, except that portion which is covered by the popliteus. Its fibres pass obliquely downwards and forwards towards a strong tendon which runs along its edge, and is continued behind the tibia, thence (through a depression lined by cartilage) along the astragalus, where it is bound down by a ligamentous sheath. About the middle of the sole of the foot it divides into four tendons, but just before its division, it is joined by a tendinous slip from the flexor pollicis longus.

Insertion. Into the third phalanges of the four lesser toes, after passing through the divisions in the tendons of the flexor brevis digitorum.

The tendon, where passing along the tibia, is enclosed in a synovial *sheath.* A second surrounds the tendon, and that of the flexor pollicis longus in the sole. The tendons on each toe, with those of the flexor brevis, are included in proper sheaths of synovial membrane.

Use. To extend the foot upon the leg, and at the same time to bend the third phalanges of the toes.

3. M. FLEXOR POLLICIS LONGUS.

Situation. On the lower and back part of the fibula; it is shorter, but stronger than the former muscle.

Origin. Tendinous and fleshy, by a double order of fibres from the greater part of the lower half of the posterior surface and outer edge of the fibula, with the exception of the undermost portion. The fibres pass obliquely to a middle strong tendon, which passes inwards behind the tibia to the sole of the foot, being continued in a cartilaginous groove of the os calcis, through a ligamentous sheath, and then runs along the flexor brevis pollicis.

Insertion. Into the under part of the second bone of the great toe.

The tendon is included in a synovial *sheath* at the os calcis, and at the great toe.

Use. To bend the great toe, and to assist in extending the foot upon the leg.

Before we trace the tendons of the above muscles to their insertion, it is necessary to dissect the middle of the sole of the foot, or the middle plantar region. The integuments are first to be dissected back, in order to display the Plantar Fascia, *aponeurosis plantaris*. This, like that of the palm of the hand, is a strong tendinous expansion, which covers the muscles, vessels, and nerves of the sole of the foot. It is attached posteriorly to the tuberosity of the os calcis, and extends forwards to the roots of the toes, and at the sides upon muscles, being strongest in the middle and behind. It is more or less distinctly divided into three portions, the two lateral being spread upon the muscles of the great and little toes. The middle portion, which is the most considerable, is subdivided into five slips, which split at the toes, and are fixed on each side at their roots.

MIDDLE PLANTAR, containing six muscles.

1. M. **FLEXOR BREVIS DIGITORUM COMMUNIS.** *Sublimis perforatus.*

Situation. Immediately above the aponeurosis.

Origin. Tendinous and fleshy from the under and fore part of the tuberosity of the os calcis, and from the aponeurosis plantaris. It forms a thick, short, fleshy belly which sends off four small tendons, and these divide to form passages for the tendons of the flexor longus.

Insertion. Into the second phalanges of the four small toes.

Use. To bend the second phalanges.

2. M. **FLEXOR DIGITORUM ACCESSORIUS.** *Massa carnea Jacobi Sylvii.*

Situation. Between the tarsal arch above and the last-mentioned muscle below.

Origin. By two portions. The inner and smaller fleshy from the ligament which is stretched between the astragalus and tuberosity of the os calcis; the outer and larger tendinous, but soon becoming fleshy from the fore and outer part of the tuberosity of the os calcis.

Insertion. Into the tendon of the flexor longus before it divides.

Use. To assist the flexor longus.

3. M. **LUMBRICALES.** Are four small muscles, which resemble those in the palm of the hand.

Origin. Tendinous and fleshy from the inside of the tendons of the flexor longus just before its division.

Insertion. By slender tendons which spread on the inside

of the first joint of the four small toes, and are fixed to the bones of the first phalanx and tendons of the extensors.

Use. To increase the flexion of the toes.

The remaining muscle in the deep posterior tibial region is

4. M. Tibialis Posticus.

Situation. Between the tibia and fibula, and covered partially below by the flex. long. dig. com. on the inner, and the flex. long. poll. on the outer side, which must be turned aside to expose the muscle completely.

Origin. Fleshy from the upper half (nearly) of the posterior surface of the tibia, from the inner surface of the fibula, and from the greater part of the interosseous ligament. The fleshy fibres pass obliquely to a middle tendon, which is about two inches above the back of the ankle joint, passes between the tendon of the flex. long. dig. and the tibia, and is continued on the inner side of that tendon through a groove behind the inner malleolus; and afterwards proceeds in a similar groove on the upper part of the astragalus to the sole of the foot. At that part the tendon usually contains a sesamoid bone, and divides into two slips.

Insertion. One of the tendinous slips is attached entirely to the os naviculare. The other divides into several slips, which are fixed to the os naviculare, astragalus, and the three ossa cuneiformia.

The tendon, where it passes into the sole, is surrounded by a sheath of synovial membrane.

Use. To extend the foot, and turn it inwards.

d. Fibular, containing the long and short peroneal muscles which are placed on the fore and lateral part of the fibula.

1. M. Peroneus Longus.

Situation. Extends along the outside of the leg.

Origin. Tendinous and fleshy from the head, from the upper and smaller half of the anterior surface, and from the outer edge of the fibula; the fibres pass obliquely to a strong tendon, which is continued along the fibula, and descends behind the outer malleolus, where it runs through a ligamentous sheath. It is then turned forwards and passes through a groove in the os cuboides, and runs inwards across the sole, covered by the muscles at that part.

Insertion. Into the metatarsal bone of the great toe, and the os cuneiforme internum.

Use. To extend the foot outwards upon the leg.

In the tendon opposite the cuboid bone is usually found a sesamoid bone. A considerable *bursa* surrounds the tendon at the outer malleolus; and another extends with it into the sole of the foot.

2. M. PERONEUS BREVIS.

Situation. Rather anterior to but partially covered by the former muscle.

Origin. By a sharp fleshy attachment above and by a double order of oblique fibres from the lower part of the anterior surface, and from the outer edge of the fibula to near the outer malleolus. The fibres are attached to a strong middle tendon which becomes rounder, and descends from the muscle in a groove behind the outer malleolus, being there included in the same ligament with that of the former muscle; but afterwards in a sheath of its own.

Insertion. Into the base of the metatarsal bone which supports the little toe.

Use. To extend the foot upon the leg.

The tendon of this muscle is surrounded by a bursa of its own at the outer side of the foot, in addition to that which it has in common with the peroneus longus.

§ 4. ON THE FOOT.

DORSAL, on the instep, containing one muscle.

M. EXTENSOR BREVIS DIGITORUM COMMUNIS.

Situation. On the upper and outer part of the foot.

Origin. Tendinous and fleshy from the fore and upper part of the os calcis. It is formed of four slender fleshy bellies, which pass obliquely inwards, and terminate in an equal number of tendons.

Insertion. Into the upper part of the first bone of the great toe, and of the three small toes which are next to it, the tendons spreading upon these and intermixing with the tendinous expansions of the long extensor of the small toes.

Use. To extend the four larger toes.

On the sole of the foot are found

a. MIDDLE PLANTAR, already described. See page 122.

b. INNER PLANTAR, containing three muscles.

1. M. ABDUCTOR POLLICIS.

Situation. Along the inner edge of the sole of the foot.

Origin. Tendinous and fleshy from the inside of the protuberance of the os calcis, and from the fore and projecting part of the same bone.

Insertion. Tendinous into the inner sesamoid bone, and into the root of the first bone of the great toe.

Use. To draw the great toe inwards from the others.

2. M. FLEXOR BREVIS POLLICIS.

Situation. On the outer side of the last muscle.

Origin. Tendinous from the under and fore part of the os calcis and os cuneiforme externum. Its fleshy belly is usually divided into two portions by the tendons of the flex. long. poll. and is intimately connected with the adductor and abductor pollicis.

Insertion. Into the ossa sesamoidea and the root of the first bone of the great toe.

Use. To flex the great toe.

3. M. ADDUCTOR POLLICIS.

Situation. In the middle of the sole of the foot, and close to the metatarsal arch.

Origin. Tendinous from the os calcis, the os cuboides, the os cuneiforme externum, and the root of the metatarsal bone of the second toe.

Insertion. Into the outer sesamoid bone and root of the metatarsal bone of the great toe.

Use. To bring the great toe towards the others.

c. OUTER PLANTAR, containing two muscles.

1. M. ABDUCTOR MINIMI DIGITI.

Situation. On the outer edge of the sole of the foot.

Origin. Tendinous without and fleshy within from the under and back of the protuberance of the os calcis, and from the base of the metatarsal bone of the little toe.

Insertion. Tendinous into the outer side of the root of the first bone of the little toe.

Use. To draw the little toe outwards.

2. M. FLEXOR BREVIS MINIMI DIGITI.

Situation. To the inner side of the last muscle.

Origin. Tendinous from the os cuboides, near the groove, in which the tendon of the peroneus longus is lodged; and fleshy from the base of the metatarsal bone, which supports the toe.

Insertion. Into the anterior extremity of the metatarsal bone, and the root of the first bone of the little toe.

Use. To flex the little toe.

d. INTEROSSEAL, containing the

1. M. TRANSVERSALIS.

Situation. Runs transversely across the extremities of the metatarsal bones, above the tendons of the flexor muscles.

Origin. Tendinous from the under part of the anterior extremity of the metatarsal bone of the great toe, and from the outer sesamoid bone.

Insertion. Into the under and outer part of the metatarsal bone of the little toe.

Use. To assist in supporting the arch of the foot transversely.

2. M. INTEROSSEI PEDIS.

In the foot as in the hand are seven small muscles, which are situated in the spaces between the metatarsal bones, arising from their posterior extremities and sides; while their tendinous insertions intermix with the tendons of the extensors of the toes. These consist of four external and of three internal muscles, and are thus distinguished:—

INTEROSSEI DORSALES, SEU EXTERNI BICIPITES.

1. M. PRIOR INDICIS PEDIS.

Origin. Tendinous and fleshy, by two origins, from the roots of the metatarsal bones of the fore toe and of the great toe.

Insertion. Tendinous, into the inside of the root of the first bone of the great toe. fore toe

Use. To pull the great toe inwards from the others.

2. M. POSTERIOR INDICIS PEDIS.

Origin. Tendinous and fleshy, from the roots of the metatarsal bones of the fore and middle toes.

Insertion. Tendinous, into the outside of the root of the first bone of the fore toe.

Use. To pull the great toe towards the others.

3. M. POSTERIOR MEDII DIGITI PEDIS.

Origin. Tendinous and fleshy, from the roots of the metatarsal bones of the middle and third toes, fourth

Insertion. Tendinous, into the outside of the root of the first bone of the middle toe.

Use. To pull the middle toe towards the fourth.

4. M. Posterior Tertii Digiti Pedis.

Origin. Tendinous and fleshy, from the roots of the metatarsal bones of the third and of the little toe.

4th

Insertion. Tendinous, into the outside of the root of the first joint of the third toe.

Use. Same as the last.

Interossei Plantares seu Interni.

1. M. Prior Medii Digitii Pedis.

Origin. Tendinous and fleshy, from the inside of the root of the metatarsal bone of the middle toe.

Insertion. Tendinous, into the inside of the root of the first bone of the middle toe.

Use. To pull the middle toe inwards.

2. Prior Tertii Digiti Pedis.

Origin. Tendinous and fleshy, from the inside and inferior part of the root of the metatarsal bone of the third toe.

Insertion. Tendinous, into the inside of the root of the first bone of the third toe.

Use. To pull the third toe inwards.

3. Prior Minimi Digiti Pedis.

Origin. Tendinous and fleshy, from the inside of the root of the metatarsal bone of the little toe.

Insertion. Tendinous, into the inside of the root of the first bone of the little toe.

Use. To pull the little toe inwards.

The relative Situation of the Muscles in the Sole of the Foot.

As soon as the skin and fat have been removed, the Plantar Fascia is exposed, divided like that of the hand into three portions, of which the middle covering the middle plantar region is the thickest, and the inner covering the inner plantar region the thinnest.

After dissecting off the fascia,

In the *first layer*, the flexor brevis digitorum pedis is found in the *middle*, its tendons passing towards the toes, and pierced by the flexor longus dig. ped. and having the tendons of the lumbricales between them; on the *outside* is seen the abductor minimi digiti and part of the flexor brevis min. dig.; on the *inside* the abductor pollicis pedis, the tendon of the flexor longus poll. and part of the flexor brevis poll.

In the *second layer*, the flexor brevis digitorum, ~~flex. brev~~, abduct.

min. dig., tendon of the flex. long. poll. and abductor poll. having been removed, in the *middle* is seen the flexor accessorius with its insertion into the tendon of the flexor longus digitorum and the origins of the lumbricales from the tendons of the same muscle: on the *outside*, the whole of the flexor brev. min. dig.; on the *inside* more of the flex brev. poll.

In the *third layer*, the flexor accessorius and tendons of the flex. long. dig., and lumbricales having been removed, in the *middle* is seen the adductor pollicis, and along the heads of the metatarsal bones the transversalis pedis: on the *outside* some of the interossei pedis plantares; and on the *inside* the whole of the flexor brev. poll., and posteriorly the insertion of the tibialis anticus & posticus, and after opening its sheath, the tendon of the peroneus longus.

§ TABLE EXHIBITING THE ACTIONS OF THE MUSCLES OF THE LOWER EXTREMITY:

Those, namely, by which the movements of the Femur, Leg, Foot, Tarsus, and Toes, are performed. For some general observations, see p. 92.

The Motions of the Femur upon the pelvis are those of *extension*, or carrying it backward—*flexion*, or carrying it forwards—*abduction*, or carrying it outwards, as in separating the thighs—*adduction*, or carrying it inwards, as in approximating the thighs—*rotation*, or turning it upon its axis, either inwards or outwards. The muscles have, therefore, been divided into—*a.* Extensors, *b.* Flexors, *c.* Abductors, *d.* Adductors, *e.* Rotators inward, *f.* Rotators outward.

a. Extensors:

1. Gluteus maximus.
2. Gluteus medius (part of.)
3. Pyriformis.
4. Obturator internus.
5. Gemini.
6. Quadratus.
7. Adductor magnus (portion from the tuber ischii.)
8. Biceps (long head of.)
9. Semi-membranosus.
10. Semi-tendinosus.

b. FLEXORS.

1. Iliacus.
2. Psoas magnus.
3. Sartorius.
4. Tensor vaginæ femoris.
5. Gracilis.
6. Adductor longus.
7. Adductor brevis.
8. Adductor magnus.
9. Obturator externus.
10. Pectineus.
11. Rectus.

c. ABDUCTORS.

1. Gluteus maximus.
2. Gluteus medius.
3. Gluteus minimus.
4. Tensor vaginæ femoris.
5. Pyriformis.
6. Gemini.
7. Obturator internus.

d. ADDUCTORS.

1. Iliacus.
2. Psoas magnus.
3. Pectineus.
4. Gracilis.
5. Adductor longus.
6. Adductor brevis.
7. Adductor magnus.
8. Obturator externus.
9. Quadratus.

e. ROTATORS OUTWARD.

1. Gluteus maximus.
2. Gluteus medius.
3. Pyriformis.
4. Gemini.
5. Obturator internus.
6. Obturator externus.
7. Quadratus femoris.

8. Iliacus.
9. Psoas magnus.
10. Adductor longus.
11. Adductor brevis.
12. Adductor magnus.

f. ROTATORS INWARD.

1. Tensor vaginæ femoris.
2. Gluteus medius (anterior portion of.)
3. Gluteus minimus (anterior portion of.)
4. Sartorius.
5. Gracilis.

The MOTIONS OF THE LEG upon the thigh, are those of *flexion* and *extension*. There are also slight *rotations* when the leg is bent. The muscles, therefore, are divided into—*a*. EXTENSORS, *b*. FLEXORS, *c*. ROTATORS INWARD and OUTWARD.

a. EXTENSORS.

1. Rectus.
2. Cruralis.
3. Vastus externus.
4. Vastus internus.

b. FLEXORS.

1. Gracilis.
2. Sartorius.
3. Semi-tendinosus.
4. Semi-membranosus.
5. Biceps
6. Gastrocnemius externus.
7. Plantaris.
8. Popliteus.

c. ROTATORS INWARD.

1. Gracilis.
2. Sartorius.
3. Semi-membranosus.
4. Semi-tendinosus.
5. Popliteus.

d. ROTATOR OUTWARD.

1. Biceps.

The MOTIONS OF THE FOOT upon the Leg, are those of *extension*, by which the foot and toes are pointed downwards—*flexion*, by which the foot and toes are pointed upwards—*inflexions inward* and *outward*, which do not take place, however, in the ankle joint, but between the two rows of the tarsal bones. The muscles may be divided into—*a.* EXTENSORS, *b.* FLEXORS, *c.* INFLECTORS INWARD, *d.* INFLECTORS OUTWARD.

a. EXTENSORS.

1. Gastrocnemius externus.
2. Gastrocnemius internus.
3. Plantaris.
4. Flexor longus digitorum.
5. Flexor longus pollicis.
6. Tibialis posticus.
7. Peroneus longus.
8. Peroneus brevis.

b. FLEXORS.

1. Tibialis anticus.
2. Extensor longus digitorum.
3. Extensor proprius pollicis.

c. INFLECTORS INWARD.

1. Tibialis posticus.
2. Extensor proprius pollicis.
3. Flexor longus digitorum.
4. Flexor longus pollicis.

d. INFLECTORS OUTWARD.

1. Peroneus longus.
2. Peroneus brevis.
3. Extensor longus digitorum.

The MOTIONS OF THE TOES are those of *flexion—extension—abduction—adduction*. The muscles, therefore, may be divided into—*a.* FLEXORS, *b.* EXTENSORS, *c.* ABDUCTORS, *d.* ADDUCTORS.

a. FLEXORS.

1. Flexor longus digitorum.
2. Flexor brevis digitorum.
3. Flexor accessorius digitorum.
4. Lumbricales.
5. Flexor longus pollicis.
6. Flexor brevis pollicis.
7. Flexor brevis minimi digiti.

b. EXTENSORS.

1. Extensor longus digitorum.
2. Extensor brevis digitorum.
3. Extensor proprius pollicis.

c. ABDUCTORS.

1. Abductor pollicis.
2. Abductor minimi digiti.
3. Interossei: $\begin{cases}\text{Prior indicis.}\\ \text{Prior medii digiti.}\\ \text{Prior tertii digiti.}\end{cases}$

— Minimi Digiti

d. ADDUCTORS.

1. Adductor pollicis.
2. Transversalis.
3. Interossei: $\begin{cases}\text{Prior minimi digiti.}\\ \text{Posterior indicis.}\\ \text{Posterior medii digiti.}\\ \text{Posterior tertii digiti.}\end{cases}$

CHAPTER IV.

Of the Joints of the Lower Extremity.

For general directions respecting the dissection of these parts, see p. 98.

The Joints of the Lower Extremity are—1. Those of the Pelvis.—2. Hip joint.—3. Knee joint.—4. Those of the Tibia and Fibula.—5. Ankle joint.—6. Joints of the Foot.

§ 1. OF THE PELVIS.

The articulations of the bones of the pelvis are formed in part by ligamento-cartilaginous substances; and in part by ligaments: but distinct synovial capsules are not found.

a. Sacro-iliac Symphysis.

Is formed by the ilium and sacrum, and the anterior and smaller portion of the articulating surface of each bone is covered by a smooth cartilage. These cartilages touch each other, but are seldom completely united, and are lubricated by a slippery fluid, of a thicker consistence than synovia.

On the other hand the posterior and larger portions are not covered by cartilage, but are firmly united by an exceedingly tough and strong *fibro-cartilaginous structure,* which has been sometimes described as a peculiar ligament under the name of the Sacro-iliac, *Ligamentum sacro-iliacum.*

The articulation is further strengthened by one posterior and two anterior ligaments.

1. Posterior, *Ligamentum pelvis posticum.* Consisting of perpendicular and oblique fibres forming a strong broad ligament, which passes from the posterior extremity of the spine of the ilium to the transverse-like processes of the third and fourth pieces of the sacrum or false vertebræ. Besides these there are irregular *bands* which cross in different directions, and assist in strengthening the articulation.

2. Superior Anterior, *Ligamentum pelvis anticum superius.* Is formed of oblique fibres, which pass from

the posterior part of the spine of the ilium, to the transverse processes of the fourth and fifth lumbar vertebræ. It is then triangular.

3. INFERIOR ANTERIOR, *Ligamentum pelvis anticum inferius*. Passes from the same part, and is attached to the transverse process of the fifth lumbar vertebra.

b. SYMPHYSIS PUBIS.

The ossa pubis where they form the symphysis are each covered by a layer of cartilage united by a *fibro-cartilaginous substance*. The union is seldom complete, and is found to vary considerably in degree, being generally separate to a greater or less extent, with a corresponding difference in the quantity of the fibro-cartilaginous substance.

The uniting medium of the symphysis is covered by a strong *layer of ligament*, which is composed of transverse fibres. These are strongest at the lower part, and are attached to the bones of the pubis. This layer is sometimes described as a Capsular Ligament, and assists materially in strengthening the junction.

c. ARTICULATION OF THE OS COCCYGIS WITH THE SACRUM.

There is a *fibro-cartilaginous substance* interposed between the articulating surfaces of these bones, which forms a bond of union between them. The articulation is strengthened by *longitudinal ligaments*, which descend from the os sacrum, spread over the os coccygis, and connect its different portions together. The ligaments at the back part which pass between the bones are the most considerable.

d. PROPER LIGAMENTS OF THE PELVIS, or those which are not appropriated to the strengthening of the articulations, are three, viz.

1. POSTERIOR SACRO-ISCHIATIC LIGAMENT, *Ligamentum sacro-ischiaticum posterius, tuberoso-sacrum.* Situated at the under and back part of the pelvis. It arises from the transverse processes of the os sacrum, from the under and lateral part of that bone, and from the upper part of the os coccygis. It passes downwards and forwards, becomes considerably narrower and thicker, and is fixed to the tuberosity of the ischium.

2. ANTERIOR SACRO-ISCHIATIC LIGAMENT, *Ligamentum sacro-ischiaticum anterius, spinoso-sacrum.* Is the smaller of the two. It arises from the same parts anterior to

the former, passes forwards across it, and is fixed to the spinous process of the ischium.

By these two ligaments the sacro-ischiatic notches are formed into complete foramina: that above the spinous process of the ischium is called the greater sacro-ischiatic hole, *for. sacro-ischiaticum majus;* and that below it the lesser sacro-ischiatic hole, *for. sacro-ischiaticum minus.*

3. Obturator Ligament, *Ligamentum obturatorium.* Is a thin ligamentous expansion composed of irregular fibres, which adhere to the margin of the foramen obturator, and fill the whole of that opening, except at the upper and outer part, where a passage is left for the obturator vessels and nerve. This opening is remarkable from its admitting occasionally of the descent of a hernia.

§ 2. OF THE HIP JOINT.

The hip joint is surrounded by thick and strong muscles, which contribute principally to give figure to it externally. From this circumstance some difficulties arise in the examination of this joint under accident or disease; it furnishes, however, a stronger reason for acquiring an intimate acquaintance with the form and proportions of the part in its natural and healthy state. The joint is composed of the os innominatum and os femoris, and the parts connected with it are:—of the os innominatum, the acetabulum, and the three bones of which it is composed which meet in the acetabulum; and of the os femoris, the head, neck, trochanter major, and trochanter minor. The only part which can be felt before the coverings have been removed is the trochanter major: but the joint itself is the least covered anteriorly.

1. Capsular Ligament, *Ligamentum capsulare.* Is the largest and most complete of any in the body. It is attached above to the outside of the brim of the acetabulum; it surrounds the head and neck of the os femoris, round the latter of which it is firmly connected. The external part is extended farther down than the internal, which is fixed to the neck by several separate bands or fræna. It is strongest at the upper, outer, and fore part; is composed of several layers of strong longitudinal fibres, and is strengthened by the surrounding muscles.

2. Cotyloid or Fibro-cartilaginous Ligament of the Acetabulum, *Ligamentum cotyloideum fibro-cartilagineum.* Is seen on cutting open the capsular ligament.

It is composed of a ligamento-cartilaginous substance, which surrounds and is attached to the brim of the acetabulum. It is stretched across the breach in that cavity so as to complete its edge, and it increases the depth of the whole cavity. The breach is filled up by strong ligamentous bands, which are sometimes called the Transverse Ligament.

3. ROUND LIGAMENT, *Ligamentum teres, rotundum.* Arises by a broad flat attachment from the under and inner part of the cavity of the acetabulum. It passes upwards, becomes rounder, and is fixed by a broad attachment to the pit on the inner surface of the head of the os femoris. It is composed of longitudinal fibres, which are continuous with the cartilaginous lip of the acetabulum.

The SYNOVIAL MEMBRANE, *Membrana capsularis synovialis.* Is continued from the acetabulum over the cartilaginous brim; it lines the capsular ligament, and descends to the outer part of the neck, reaching farther down before than behind. It is then reflected back, and covers the neck to the cartilage of the head. The ligamentum teres is included also in a process of synovial membrane.

The greater part of the acetabulum is covered by cartilage except at its under and middle part, which is the deepest, and contains a considerable quantity of fat.

The SITUATION OF THE HIP JOINT.

Anteriorly, may be easily ascertained by taking the middle of Poupart's ligament: this ligament extends from the superior anterior spinous process of the ilium to the symphysis pubis, and on the outer side of this point, about an inch and a half below it, is the front of the hip joint; on the outer and fore part the joint is covered by the psoas magnus & iliacus, as they pass over that part of the acetabulum which is formed by the ilium; but on the inner part it is immediately behind the femoral artery, which rests on that part of the body of the os pubis immediately to the outer side of the origin of the pectineus. The fore and inner part of the joint then is situated between the psoas & iliacus on the outside, and the pectineus on the inner side, about an inch and a half below Poupart's ligament, and directly behind the femoral artery.

Posteriorly. The situation of the hip joint may be described by drawing a line from the top of the greater trochanter to the tuberosity of the ischium, and an inch above the middle of this line gives the situation of the joint behind, which is covered by the muscles in the gluteal & ischiadic regions.

Practical Points. *Fractures*:—Of the acetabulum—of the neck of the os femoris (within the capsular ligament)—of the os femoris through the trochanter major.

Dislocations:—Of the head of the os femoris on to the dorsum of the ilium—into the ischiatic notch—into the obturator foramen—on to the os pubis.

§ 3. OF THE KNEE JOINT.

This joint is situated superficially. Its figure is principally produced by the form of the bones which enter into its composition. It readily, therefore, admits of examination, and alterations in its form from accident or disease are detected without difficulty. It is composed of the os femoris, the tibia and the patella; and the parts of these connected with the joint are:—of the os femoris, its condyles, their four articular surfaces, and the depression between them: of the tibia, its head, the two articular surfaces, and the tubercle: of the patella, its two articular surfaces.

The knee joint is more complicated in its structure than any other joint of the body, in consequence of the number and disposition of its ligaments, which are situated both internally and externally, and are calculated to afford great strength to the articulation; and, besides these, there are interarticular cartilages, which increase and deepen the surfaces of articulation.

a, Ligaments situated externally, are five.

1. Internal Lateral Ligament, *Ligamentum genu laterale internum.* Is the strongest of these. It arises from the fore and inner part of the inner condyle of the os femoris, and is attached below to the upper part of the inner surface of the tibia. It is composed of perpendicular fibres, and is broader above than below.

2. Long External Lateral Ligament, *Ligamentum laterale externum longum.* Is a narrow, rounded, but strong ligament, arising from the outer part of the outer condyle, and fixed below to the fore and outer part of the head of the fibula.

3. Short External Lateral Ligament, *Ligamentum laterale externum breve.* Is less considerable than the former, and is situated behind it. It arises from the pos-

terior part of the outer condyle, passes obliquely downwards, and is attached below to the head of the fibula.

4. Posterior Ligament, *Ligamentum posticum.* Is formed of irregular bands which arise from the upper and back part of the outer condyle of the os femoris, descend obliquely, and are fixed below to the inner and back part of the head of the tibia.

5. Ligament of the Patella. Is placed anteriorly, and is of great strength and size. It arises from the depression behind the apex of that bone, and is fixed below to the tubercle of the tibia. By means of this ligament the muscles inserted into the patella exert their action on the tibia in the extension of the leg.

b. Capsule of Synovial Membrane, *Membrana capsularis synovialis.* It arises from the whole circumference of the under end of the os femoris, anteriorly a little above the margin of the articulating cartilage, and posteriorly immediately above it. From this it descends and is fixed round the head of the tibia, and into the margin of the articulating surface of the patella, so that this bone projects somewhat into the cavity, and forms a part of the boundary of the joint. It is lost upon the articular cartilage of these parts. At the upper and fore part it lines also the under part of the extensors of the leg, and is connected to the other surrounding parts by a loose cellular texture.

The synovial membrane forms a fold on each side of the patella, in which are some ligamentous fibres, called the Alar Ligaments, *Ligamenta alaria.* And another fold is extended from the patella to the depression in the os femoris, called the Mucous Ligament, *Ligamentum mucosum.* Neither the Alar nor Mucous Ligaments can be seen till the capsule is cut open.

Depositions of adipose substance are found at different parts of the joint: for instance, about the circumference of the patella, in the above-mentioned fold, and between the projections of the thigh bone.

c. LIGAMENTS SITUATED INTERNALLY.

These are the crucial ligaments, which most essentially contribute to strengthen the junction of the os femoris with the tibia. They arise from the depression between the condyles, and are so called from crossing each other. They are covered by the synovial membrane, but in fact are situated externally to it.

1. Anterior Crucial Ligament, *Ligamentum cruciatum anterius.* Arises from the inner side of the outer condyle of the os femoris; it passes downwards, inwards, and forwards, crossing the posterior ligament, and is fixed below to a depression on the fore part of the head of the tibia, between the articulating surfaces.

2. Posterior Crucial Ligament, *Ligamentum cruciatum posterius.* Is stronger and broader than the former; it arises from the outer side of the inner condyle of the os femoris, it passes downwards, outwards and backwards, and is fixed to a depression on the back part of the head of the tibia, a bony protuberance separating it from the insertion of the former.

The Semilunar Interarticular Cartilages. Two in number, and named from their figure, are broader behind than before; their outer convex edge is thick, while the inner concave edge is thin and sharp; they are hollowed out above so as to render the sockets for the condyles of the os femoris deeper, are more or less flat below, and they cover about two-thirds of the tibia. The inner edge of each is unattached; the outer is fixed to the circumference of the head of the tibia, by means of the capsule of the joint, which portion is generally known as the Ligaments of the Semilunar Cartilages, *Ligamenta semilunaria.* Their extremities are attached by strong fibrous bands to the protuberance between the articulating surface on the head of the tibia, and the anterior extremities are connected by a strong transverse band, called the Transverse Ligament, *Ligamentum transversum.*

In this way the ligaments of the knee joint may be enumerated as ~~*thir*~~four*teen*, *five* without and ~~seven~~ eight within the capsule, which is usually considered as *one;* the five are, the internal lateral, the long and short external lateral, the posterior, and the ligament of the patella; the ~~seven~~ eight are, the two alar, the mucous, two crucial, two semilunar, and one transverse; the capsule makes the ~~thir~~fourteenth.

Practical Points. *Fractures:*—Of the condyles of the os femoris—of the patella.

Dislocation of the tibia:—forwards, backwards, inwards, outwards—of the patella—of the interarticular cartilages.

Loose substances within the joint.

§ 4. OF THE TIBIA AND FIBULA.

These bones are connected by four ligaments.

a. SUPERIOR ARTICULATION.

The head of the fibula is connected to the tibia by means of a short *capsule* of synovial membrane, which is strengthened on the exterior by *ligamentous bands*, extended obliquely between the bones, and these are generally called the CAPSULAR LIGAMENT. The articular surfaces of the bones are covered by a smooth cartilage.

b. IN THE MIDDLE,

The tibia and fibula are connected by the INTEROSSEOUS LIGAMENT. It is a thin expansion, one edge of which is fixed to the outer and posterior angle of the tibia, the other to the corresponding ridge of the fibula. It occupies the space between the two bones, and is composed of oblique fibres. It has an opening above for the passage of the anterior tibial vessels, and is perforated besides in various parts for the passage of the vessels and nerves.

c. INFERIOR ARTICULATION.

It is formed by the adaptation of the articular surfaces of the tibia and fibula between which a duplicature of synovial membrane is extended from the ankle joint, and by a strong ligament before and behind.

1. ANTERIOR, *Ligamentum anterius.* It arises from the outer and fore part of the extremity of the tibia, and is attached to the front of the outer malleolus of the fibula.

2. POSTERIOR, *Ligamentum posterius.* Is stretched between the corresponding points of the tibia and fibula on the posterior part.

§ 5. OF THE ANKLE JOINT.

The bones which enter into the composition of this joint are the tibia, the fibula, and the astragalus. The parts of these bones, connected with the articulation, are the malleolus externus, the malleolus internus, the two articular surfaces of the tibia, and one of the fibula, and the pulley-like articular surface and the two lateral articular surfaces of the astragalus; all of which are covered by smooth cartilage. The parts which may be distinguished before the integuments have been removed, are the malleoli; but in consequence of being sur-

rounded only by ligaments and tendons, the joint is so superficial that alterations in its form or motions are readily detected.

The LIGAMENTS connecting the bones of the leg with those of the tarsus, namely with the os calcis, the astragalus, and the os naviculare, are four; viz.

1. DELTOID LIGAMENT of the tibia, *Ligamentum tibiæ laterale internum deltoides.* It arises from the malleolus internus, spreads as it descends, and is attached below to the astragalus, the os calcis, and the os naviculare.

2. ANTERIOR LIGAMENT of the fibula, *Ligamentum fibulæ anterius.* Arises from the anterior part of the outer malleolus, and passing obliquely forwards and inwards, becomes fixed to the fore and outer part of the astragalus.

3. MIDDLE, or PERPENDICULAR LIGAMENT of the fibula, *Ligamentum fibulæ medium perpendiculare.* Arises from the extremity of the outer malleolus, and after descending nearly perpendicularly, is fixed below to the outer side of the os calcis.

4. POSTERIOR LIGAMENT of the fibula, *Ligamentum fibulæ posterius.* It arises from the inner and back part of the outer malleolus, passes nearly transversely inwards, and is attached to the back part of the astragalus.

Besides these ligaments, the joint is further strengthened by *ligamentous fibres,* which extend upon the capsule from the tibia to the astragalus.

The SYNOVIAL MEMBRANE. *Membrana articuli pedis synovialis.* Arises from the margin of the articular surfaces of the tibia and fibula, and is attached to the circumference of the articular surfaces of the astragalus.

PRACTICAL POINTS. *Dislocations:*—inward—outward—and forward.

§ 6. OF THE FOOT.

OF THE TARSAL BONES.

The bones of the tarsus are firmly united to form the tarsal arch by strong ligaments situated between the bones on the dorsal and plantar surfaces, and on the inner and outer side of the foot; which are distinguished by names designative of their situation and of the bones which they connect. The applied surfaces of these bones are covered by cartilage, and included in synovial capsules: that which connects the first with the second row being the most remarkable of these articulations.

a. OF THE ASTRAGALUS AND OS CALCIS.

Between the inferior surface of the astragalus and the upper part of the os calcis there is a distinct *synovial capsule:* in addition to which, there are strong ligaments uniting these bones, *Ligamenta astragalo-calcanea:* they are as follows:

1. INTEROSSEOUS LIGAMENT, *Ligamentum interosseum.* This consists of strong fibres, passing between the corresponding grooves which divide the opposite articular surfaces of these bones.

2. POSTERIOR LIGAMENT, *Ligamentum posterius.* It passes from the back part of the astragalus to the inner and back part of the os calcis.

3. ANTERIOR LIGAMENT, *Ligamentum anterius,* which passes from the inner part of the astragalus to the inner and fore part of the os calcis.

b. OF THE FIRST AND SECOND ROW OF THE TARSAL BONES.

There is a common *synovial membrane,* which encloses the opposed articular surfaces of the astragalus, the os naviculare, and the os calcis, and there is a distinct *synovial membrane* which includes the articular surfaces of the os calcis and the os cuboides. These bones are connected by the following ligaments; viz.

LIGAMENT BETWEEN THE ASTRAGALUS AND OS NAVICULARE, *Ligamentum astragalo-scaphoideum;* viz.

SUPERIOR OR DORSAL LIGAMENT, *Ligamentum superius.* It passes from the upper part of the astragalus to the upper part of the os naviculare.

LIGAMENTS BETWEEN THE OS CALCIS AND OS NAVICULARE, *Ligamenta calcaneo-scaphoidea;* viz.

1. EXTERNAL LIGAMENT, *Ligamentum externum.*

It passes from the fore part of the os calcis to the outside of the os naviculare.

2. INFERIOR OR INNER PLANTAR LIGAMENT, *Ligamentum inferius.* This very strong ligament passes from the under and fore part of the os calcis to the under part of the os naviculare.

LIGAMENTS BETWEEN THE OS CALCIS AND OS CUBOIDES, *Ligamenta calcaneo-cuboidea ;* viz.

1. SUPERIOR OR DORSAL. It consists usually of several bands, which pass between the upper edges of the bones.

2. EXTERNAL. Is extended on the outside between these bones.

3. INFERIOR OR OUTER PLANTAR. Is the strongest of the tarsal ligaments. It passes at the under surface of the bones.

LIGAMENTS BETWEEN THE OS NAVICULARE AND THE OS CUBOIDES, *Ligamenta scaphoideo-cuboidea ;* viz.

1. INTEROSSEOUS LIGAMENTS. A band of short transverse fibres which passes in the space between the bones.

2. SUPERIOR OR DORSAL LIGAMENT. Passes from the outer edge of the os naviculare to the upper surface of the os cuboides.

3. INFERIOR OR PLANTAR LIGAMENT. From the under part of the os naviculare to the inner edge of the os cuboides.

c. OF THE SECOND ROW OF TARSAL BONES.

LIGAMENTS BETWEEN THE OS NAVICULARE AND THE THREE OSSA CUNEIFORMIA, *Ligamenta scaphoideo-cuneiformia.*

The bones are connected by *ligamentous bands,* both above and below, passing irregularly from the os naviculare to each of the bones. They are severally distinguished, as the *plantar* and *dorsal ligaments.* Besides these there is a *synovial capsule,* between the os naviculare and the ossa cuneiformia which penetrates the interspaces of the three latter bones,

LIGAMENTS BETWEEN THE OS CUBOIDES AND THE OS CUNEIFORME EXTERNUM, *Ligam. cuboideo-cuneiformia.*

These likewise consist of *plantar* and *dorsal* ligaments, and there is a distinct *synovial membrane.*

LIGAMENTS BETWEEN THE OSSA CUNEIFORMIA, *Lig. cuneiformia.*

Consist of irregular bands, called the *interosseous,* the *dorsal,* and the *plantar* ligaments. Their synovial membrane is noticed above, as occupying the interspaces of these bones.

d. OF THE TARSAL AND METATARSAL BONES.

Between the inner cuneiform bone and the base of the first metatarsal bone, a distinct *synovial membrane* is commonly found. Another and separate *synovial membrane* includes the articular surfaces of the second metatarsal bone, and the ossa cuneiformia. A third *synovial membrane* is found between the articular surfaces of the third cuneiform, and third metatarsal bone: and the articular surfaces of the third and fourth metatarsal bones are enclosed in a common capsule, which contains likewise the anterior surface of the os cuboides.

The *ligaments* which unite the metatarsal bones to those of the tarsus, consist of irregular bands, both on the upper and under surface, called *dorsal* and *plantar:* the latter of these are very strong, particularly those by which the base of the second metatarsal bone is connected with the inner cuneiform.

The ligaments connecting the metatarsal bones to each other, the articulations between the metatarsal bones and those of the first phalanx, and the articulations between the bones of the toes, so nearly resemble the corresponding articulations in the hand, that it is not considered necessary to particularize their structure. See page 106.

SECTION III.

THE DISSECTION OF THE HEAD, NECK, AND CHEST.

CHAPTER I.

Of the Head.

§ 1. OF THE MUSCLES ON THE EXTERIOR OF THE CRANIUM, DISTRIBUTED INTO REGIONS.

a. Epicranial, containing one muscle,

M. Occipito-frontalis.

Situation. It covers the whole of the cranium between the greater transverse ridge of the os occipitis and the superciliary ridges of the os frontis; it is a thin broad digastric muscle: it is best to begin the dissection of it from the posterior part.

Origin. Tendinous and fleshy from the arched ridge of the os occipitis and root of the mastoid process of the temporal bone. Its fleshy fibres ascend upon the occiput, and terminate in a thin broad tendon, which covers the vertex, and part of the sides, of the head. At the upper part of the forehead it again becomes fleshy, and descends upon the frontal bone.

Insertion. Into the skin of the eyebrows, intermixed with the orbiculáris palpebrarum, and sends a fleshy slip by the side of the nose, which intermixes with the compressor naris and levator labii superioris alæque nasi.

Use. It pulls the skin of the head backwards, and raises the eyebrows, at the same time wrinkling the skin of the forehead.

The tendon of this muscle firmly adheres to the skin, but is loosely connected beneath, so that it will require caution in the dissection not to raise it with the integuments of the cranium.

b. AURAL, containing the four small muscles which move the whole auricle.

1. M. ATTOLLENS AUREM.

Situation. Above the ear.

Origin. Thin and broad from the tendon of the occipito-frontalis.

Insertion. Into the upper part of the ear.

Use. To raise the auricle.

2. M. ANTERIOR AURIS.

Situation. Anterior to the ear, but not always found.

Origin. From the posterior part of the zygoma.

Insertion. Into the back part of the helix anteriorly.

Use. To bring the auricle forwards.

3 & 4. M. RETRAHENTES AUREM.

Situation. Behind the ear; are two, sometimes three in number.

Origin. From the outer and back part of the root of the mastoid process.

Insertion. Into the back part of the concha.

Use. To bring the auricle backwards.

The parts, which follow next in the dissection, are, the aponeurosis, and the fleshy portion of the temporal muscle, situated on the side of the head, but classed with the muscles in the maxillary region. See page 180.

APONEUROSIS OF THE TEMPORAL MUSCLE. Is a strong tendinous expansion, which covers the whole of the upper and expanded part of the muscle. Above, it is attached around the circumference of the temporalis to the parietal and frontal bones; and below, to the whole of the zygoma and adjoining part of the os frontis. On dissecting this back, the temporalis will be laid bare.

M. TEMPORALIS.

Situation. On the side of the head or temple.

Origin. Fleshy from the semicircular ridge of the parietal bone, and from the same bone below the ridge; from all the squamous portion of the temporal bone; from the temporal process of the sphenoid bone; from the external angular process of the os frontis; and from the above-mentioned

aponeurosis. From these attachments the fibres descend in radii, and are continued to the inside of the zygoma.

Insertion. This will be afterwards described.

§ 2. DISSECTION OF THE CONTENTS OF THE CRANIUM.

The upper part of the cranium is now to be removed for the purpose of dissecting the brain. An *incision* is first to be carried through the soft parts in a circular direction, and in the course in which the saw is afterwards to be applied: the line of incision should be made from about half an inch above the orbits, directly backwards on each side to the protuberance of the os occipitis. The *saw* is next to be applied in the same track, and a deep groove is to be formed by it, but without penetrating the inner table of the skull. Lastly, with a mallet and sharp edged elevator the inner table is to be *broken* through, and the skull-cap being torn carefully away, the dura mater will be exposed.

OF THE BRAIN.

The term includes all the parts of the nervous mass, which, together with its membranes, fill the cavity of the cranium.

OF THE MEMBRANES.

They are three in number: 1. the Dura Mater; 2. the Tunica Arachnoides; 3. the Pia Mater.

Dura Mater. So called from being the firmest of the three membranes; adheres firmly to the inside of the skull, particularly in the young subject, in consequence of the vessels passing from it to the bones to which it forms an internal periosteum. It is first seen when the calvarium has been raised. It lines the whole interior of the cranium, and is extended with the spinal marrow through the vertebral canal. Its *exterior* surface appears rough after its separation, from the *torn* state of the vessels and cellular structure connecting it with the bone. Upon it are seen numerous little bodies, called

Glandulæ Pacchioni, distributed in different parts, but more numerous near a depression which passes in the mesial line from before to behind, and marks the course of the Longitudinal Sinus: slit it up, and show the

CONTENTS OF THE LONGITUDINAL SINUS: these are, the openings of the veins, the greater number of which take their course, and enter the sinus obliquely from behind to before; the *chordæ Willisii*, numerous tendinous fibres, near the orifices of the veins; and likewise a number of the *glandulæ Pacchioni.*

Cut through the Dura Mater on one side, and turn it back; its *internal* surface will then be seen smooth and unconnected, except where the veins enter the sinuses: it is lubricated by a secretion which gives facility of motion, and prevents the ill effects of friction.

The structure of the Dura Mater is dense, firm, and tendinous-like. It is one of the thickest and strongest membranes of the body. It has been said to be composed of layers: and parts of it may, in fact, be separated into two or more thin portions, but it possesses no regularly laminated structure. It is made up of numerous tendinous-like fibres, which may be separated by maccration: they run in various directions, and are intimately matted together. Some of them have a shining appearance, and are particularly distinct on the inner surface. The dura mater is not a very vascular part; it is principally supplied by a branch from the internal maxillary artery, called spheno-spinal, which, after passing through the spinous foramen, ramifies on the sides of the membrane. It is likewise supplied by branches from the internal carotid and the vertebral arteries. The vessels most manifest on the exterior of the membrane are the veins, which are placed external to the arteries, accompanying them, and terminating, some in the nearest sinuses, and others, after passing through perforations in the cranium, in the internal and external jugular veins. These vessels are the principal cause of the adhesion: but at some parts the connection is much more intimate, as at the sutures, from processes which pass in between them, and at the different foramina from other processes which are continued along with the nerves.*

The Dura Mater sends in several Processes between the different parts of the brain, and also forms the Sinuses, which answer nearly the same purpose as veins. Neither the processes or sinuses, however, can be properly seen till the whole of the cerebral mass has been removed; but they are described here as being formed by the Dura Mater.

PROCESSES OF THE DURA MATER.

1. FALX MAJOR (falciform process.) So called from being like a sickle; or Septum Cerebri, from its separating the two hemispheres of the cerebrum; is formed by a doubling of the dura mater. It begins from the crista galli and middle of the sphenoid bone; is continued directly backwards as far as the protuberance of the os occipitis. It is attached in its

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* The paragraphs in small print may be read at the student's leisure, as they principally refer to the intimate structure of the parts described, and may therefore be omitted in the dissection.

x Posterior Meningeal Arteries from Occipital & vertebral pass
through For: Lac: Bas: Cranii — Anterior Meningeal
from the Opthalmic of the Int Carotid

course to the bones above-mentioned, to the spine of the os frontis, to the junction of the ossa parietalia, and behind to the upper half of the perpendicular ridge of the os occipitis. It is at first narrow, but gradually becomes broader as it extends backwards; and terminates at the transverse ridge of the os occipitis by dividing into the layers, which form the tentorium.

2. Tentorium Cerebelli (transverse septum, lateral processes.) Is formed by the division of the falx, and by two layers from below, thus constituting a double layer of dura mater. It is continued horizontally over the upper part of the cerebellum. It is severally attached to the transverse ridges of the occipital bone, to the edges of the petrous portions of the temporal bone, and to the posterior clinoid processes of the sphenoid bone. In the midst, behind the sphenoid bone and between the two processes, is a large opening of communication, through which passes the isthmus of the brain, or that process by which the cerebrum and cerebellum are united. The processes, though called transverse, give a tense covering to the cerebellum rather in the form of an arch or vault, which is supposed to defend it from the pressure of the superincumbent cerebrum.

3. Falx Minor (septum cerebelli.) Is placed between the lobes of the cerebellum. It commences from the tentorium, opposite the greater falx, passes down to the foramen magnum, is of inconsiderable breadth, and diminishing as it descends, terminates at the edge of that opening. It adheres to the lower part of the perpendicular ridge of the os occipitis.

Sinuses of the Brain.

The principal vessels which return the blood from the brain are called *Sinuses*. They differ from the veins in structure and in figure; their shape is triangular; they have no valves, and do not accompany the arteries. There are four principal sinuses, viz.

1. Superior Longitudinal Sinus (falciform.) This may now be examined, by cutting through the dura mater which forms its upper wall. It begins at the crista galli, passes directly backwards, is placed in the upper part of the falx major, being situated under the sagittal suture, and terminates opposite the protuberance of the os occipitis. It is narrow in its commencement, becomes more capacious in its course backwards, and terminates in the lateral sinuses, most commonly in the right.

2 & 3. LATERAL SINUSES, two in number. Begin at the termination of the longitudinal sinus, pass outwards on each side in the grooves of the transverse ridges of the os occipitis, are continued in the sulci of the temporal and occipital bones, at first outwards, then downwards, and terminate at the base of the cranium, in the internal jugular veins, at the foramina lacera basis cranii, where those veins begin.

4. TORCULAR HEROPHILI (fourth sinus.) Obtained this name from the exploded notion that the blood is squeezed as in a *torcular* or wine-press. It is formed by the vena magna galeni (afterward to be shown;) it passes backward between the falx and tentorium; and, descending a little, terminates, most commonly, in the left lateral sinus.

These are the four which are important with respect to size and function. The others have been thus enumerated:

5. INFERIOR LONGITUDINAL SINUS. Situated at the under edge of the falx; of small size, round, receives veins from the adjacent parts, and terminates in the torcular Herophili.

6. CIRCULAR SINUS (of Ridley.) Placed about the pituitary gland, terminates in the cavernous sinuses.

7 & 8. CAVERNOUS SINUSES. Situated at the sides of the sella tursica, receive branches from the adjacent parts and from the ocular veins, surround the carotid arteries, appear cellular, and communicate with the superior and inferior petrosal sinuses.

9. SUPERIOR PETROSAL SINUSES. Situated on the ridges of the petrous portions of the temporal bone, receive blood from the cavernous sinuses and adjacent parts, and terminate in the lateral sinuses.

10. INFERIOR PETROSAL SINUSES. Situated at the roots of the petrous portions of the temporal bone, receive blood from the cavernous sinuses, communicate with each other by

11. The TRANSVERSE SINUS (which runs across the basilar process of the os occipitis,) and with the jugular veins, but not with the lateral sinuses.

12. OCCIPITAL SINUSES. Situated near the foramen magnum, communicate with the inferior petrosal and lateral sinuses, and the vertebral veins. The sinuses communicate at many parts with veins which pass through the bones of the skull.

Cut round the Dura Mater on a level with the section of the skull, and divide the falx major which passes between

the lateral halves of the brain: this incision allows the membrane to be turned back, and exposes the

Tunica Arachnoides. Is exceedingly thin, and therefore not easily distinguished from the pia mater, which it covers; but if a small opening be made, and air blown into it, the membrane will be made apparent, and the air seen to insinuate itself through the reticular texture which connects it with the pia mater. At the base of the brain, as may be seen hereafter, (page 159,) it is much more distinct, being less connected with the pia mater. It is very tender in its texture, and has a whitish appearance, but is nearly transparent. It covers the whole surface of the brain, (and is continued with the medulla oblongata, and spinal marrow;) but does not extend *round* the surface of each convolution, being spread from one to the other: it is most distinct above the interstices of the convolutions. It forms a smooth polished surface, where it is in contact with the Dura Mater.

Pia Mater. Is the third and close covering to the brain, situated immediately under the arachnoid membrane. It is extended not only over the whole surface of the brain, entering also into its larger divisions, but dips in between the convolutions; and quitting the tunica arachnoides, it envelopes each eminence and depression on the surface, and forms the *Tomentum Cerebri* of Ruysch. It is also continued into the interior, to line the cavities of the brain, entering at four points, viz.—at the inferior cornu of each lateral ventricle; under the fornix and at the bottom of the fourth ventricle. Its texture is tender. It varies in thickness and consistence at different parts. When raised from the brain, its inner surface has a flocculent appearance, from the fine vessels which pass from it to the brain; and when injected, the membrane appears to consist almost entirely of blood-vessels. The larger branches, derived from the base of the brain, take their course through the pia mater, ramify and divide minutely, so as to form an intricate network of vessels, from which minute branches are sent into the brain. The veins of the pia mater are very large, and pass towards the sinuses in which they terminate.

OF THE BRAIN.

The term Brain includes three different parts, into which the mass is divided, viz. 1. Cerebrum. 2. Cerebellum. 3. Medulla Oblongata. Some have comprehended also under the general term a fourth part, namely, Medulla Spinalis.

CEREBRUM.

Is the largest of the divisions. It is situated in, and fills the upper part of the cranium. Is of an oval rounded figure, and divided by a middle longitudinal fissure, *fissura longitudinalis*, into which the falx major descends, into two equal and similar halves, called its *hemispheres*. Their upper and outer surface is rounded, their inner surfaces, which are in apposition to each other, are flattened, and the lower surface is divided in each into three lobes. The surface of the hemispheres, more especially at the outer and upper part, is irregular, divided into a number of turning or winding eminences, called convolutions, *gyri*, with corresponding depressions between them, called *sulci*. They run in various directions; their breadth, length, and depth, vary on the same side, and do not correspond on the opposite sides.

DISSECTION OF THE CEREBRUM.

Separate the hemispheres and the

Corpus Callosum, *Commissura magna cerebri*, will be seen; it is a transverse oblong portion of medullary matter connecting the two hemispheres, and situated nearer their anterior than their posterior extremities. It is about three inches long, is narrower before than behind, and is continued on each side into the substance of the hemispheres. Along the middle of its upper surface runs, from before to behind, a line formed by a slight depression between two inconsiderable ridges, called the *raphe*: from each side of the raphe issue transverse striæ, which are continued into the hemispheres. The posterior extremity of the corpus callosum presents a rounded transverse eminence, which renders this extremity thicker than the other.

When the dissection has been prosecuted further, it may be seen that the anterior extremity does not terminate, as it appears to do, between the hemispheres, but is turned downwards, so as to form a concavity towards the ventricles, is stretched over the fore part of the corpora striata, and thus encloses the ventricles anteriorly; it terminates by a layer, which is extended backwards between the hemispheres, and forms the parietes of the ventricles superiorly; this becomes narrow pointed, and reaches to the crura of the fornix. Between these layers the septum of the ventricles is stretched perpendicularly.

Remove the hemispheres by making a section of them from the corpus callosum outwards, and rather upwards, which produces the appearance called *centrum ovale;* in it is seen the disposition of the two substances composing the brain, viz. the *cineritious* or *cortical*, and the *medullary*.

The darker substance on the outside, is called the *cineritious*, from its greyish or ash colour, or *cortical*, from its surrounding, like a bark, the inner parts of the brain: the convolutions are seen each receiving a covering from a layer of the cineritious substance, which is not more than from 1 to 1½ line in thickness. The inner substance is called *medullary*, it is white in colour, and much more abundant.

Make a longitudinal incision on each side of the corpus callosum, and open the middle or bodies of the

LATERAL VENTRICLES, *Ventriculi laterales:* these are cavities of considerable extent, which occupy the middle parts of the cerebrum, are separated by a *septum*, and said to contain in each, the *plexus choroides*, the *corpus striatum*, the *thalamus nervi optici*, and the *tænia semicircularis*.

THE SEPTUM OF THE VENTRICLES, *Septum lucidum.* Is seen by gently raising the corpus callosum. Above it is connected to that body through its whole length, and below with the fornix, but only on the posterior part, for anteriorly, and beyond the separation of the crura, it is extended between the two layers of the corpus callosum. It is of a triangular figure, considerably deeper and thicker anteriorly, and gradually tapering hindwards. It is composed of two distinct medullary layers, and these are lined by a delicate membrane, particularly distinct in cases of accumulations of fluid. The space which is thus left between the two layers is called the Ventricle of the Septum, or fifth ventricle, *Fossa Sylvii*, but it is nothing more than a fissure; it varies somewhat in form and size. It has not been yet decided whether it communicates with the other ventricles. It may easily be seen by cutting the septum transversely from behind to before, below the corpus callosum, the sides will then fall down like the leaves of a book.

PLEXUS CHOROIDES. Is a vascular fold of pia mater, partly covering the thalami nervorum opticorum, and continued backwards upon them. Its extent will be afterwards traced. On raising it, the thalami and the tænia semicircularis will be seen more distinctly.

On the fore and outer part of the ventricles are seen the

CORPORA STRIATA: two pyriform bodies of cineritious colour. They are placed obliquely; their anterior larger extremities forwards, and their posterior narrow extremities backwards, and a little outwards. Behind and to the inner edges of the corpora striata, are the

THALAMI NERVORUM OPTICORUM: two bodies of a white colour from the medullary structure of their exterior; of a rounded figure, and larger behind than before; anteriorly they are lengthened, become narrower, and converge. The

TÆNIÆ SEMICIRCULARES are seen, one on each side in the groove between the corpus striatum and thalamus, forming a narrow *medullary* band. The

LATERAL VENTRICLES, *Magni, tricornes.* Are situated on each side of the corpus callosum, fornix and septum; their figure is irregular, but lengthened from behind to before. The centrum ovale is said to form their roof; but it is rather formed by the corpus callosum. A middle part or body, and three cornua or horns are distinguished in each. The *middle part,* already described, passes from behind to before, is bounded on the inner side by the septum and corpus callosum, on the outer by the corpus striatum: its floor is formed by the fornix. Of the *Cornua* the *anterior* is the smallest; it is to be displayed by extending the incision which has already opened the ventricle, forwards and a little outwards, when its course will be seen forwards, outwards and downwards; it lies between the anterior boundary of the cavity, and the fore part of the corpus striatum, the *contents* of this cornu are said to be the bulbous extremity of the corpus striatum, and the foramen Munroianum. The *posterior* is continued from the hinder extremity of the middle part; it is also called *fovea digitata;* it is about an inch in length, but in this it varies. It is turned backwards with a slight bend only inwards, gradually narrowing and ending in a blunt extremity; and in this direction the incision to expose it should be made. Its inner wall forms a considerable projection, called *eminentia digitalis, calcar, unguis, vel pes hippocampi minor,* which is very rarely found wanting; but varies considerably in size and form; it is medullary without, and cineritious within. The *inferior* or *descending cornu,* is the largest: it passes downwards, then forwards and inwards, forming a considerable bend, of which the concavity is inwards, the convexity outwards along the crus cerebri, and occupies the under, inner, and fore part of the middle lobe; it terminates at about half an inch distance from its extremity. The incision to display it must follow its course. Within the descending cornu are seen the *plexus choroides,* the *hippocampus major,* the *eminentia collateralis,* the *tænia hippocampi,* the *pes hippocampi,* and the *fascia dentata.*

The *plexus choroides*, after extending through the middle part of the lateral ventricle, and becoming gradually broader, descends through the inferior cornu upon the tænia and cornu Ammonis. The *hippocampus major, cornu Ammonis, vel arietis*, runs along the descending cornu, and forms a bend like it, becoming, in its passage from behind to before, gradually broader and higher; it terminates by a broad extremity, which is turned inwards at the extremity of the descending cornu, and at this part has often four or five small indentures, which present a knuckle-like appearance, called the *pes hippocampi:* Usually there is a second eminence running along behind it, the *eminentia collateralis*. Along the inner concave edge of the hippocampus major runs a narrow, medullary, sickle-shaped band, called *tænia*, or *fimbria hippocampi*, with a sharp inner edge, upon which the *plexus choroides* lies: it is the continuation of the posterior crus of the fornix, and terminates about half an inch sooner than the hippocampus major, imperceptibly in a convolution: it is at this concave edge that the pia mater enters into the inferior cornu of the lateral ventricle. By the side of the tænia, but somewhat covered by it, more backwards and inwards, runs a similar cineritious projection, with numerous notches, called the *fascia dentata, vel corpus fimbriatum.*

The lateral ventricles are formed by continuous brain-substance, except where bounded by the fornix and its crura, or *fimbriæ*, which are not continuous with their walls; so that when the pia mater and tunica arachnoides have been removed, a passage is formed, without cutting, from the lateral into the third ventricle, and from the inferior cornu to the exterior of the brain.

A section of the hippocampus major shows its structure. Its surface is formed of a layer of medullary matter which is continuous on the inside with the tænia hippocampi, and both are connected above, with the substance of the fornix and corpus callosum. Under it is a layer of cineritious substance, beginning at the indented band, *fascia dentata.* In the doubling of this last stratum is a second thinner layer of medullary substance.

The next part to be noticed, is the

FORNIX. It is situated beneath the septum, and forms a vaulted covering to the third ventricle, from which it has received its name. Above and behind it is continuous with the corpus callosum; before, and in the greater part of its length, with the septum lucidum. The upper surface is convex, the under concave; the latter lies upon, and covers for the most part, the thalami, and is continued downwards and forwards. The whole of the middle part, which is flattened from above to below, is called *the body*. Under the anterior part of the fornix, between the extremities of the thalami, is situated, on each side, a small opening, called the *foramen*

Monroianum, they form communications between the third and lateral ventricles.

The Fornix is now to be divided transversely, and the divided portions reflected; it will then be seen composed of four pillars, *crura fornicis,* two anterior and two posterior. The two *anterior* pillars diverge from the body of the fornix, pass downwards, immediately behind the anterior commissure, and disappear on the inner sides of the front of the thalami, through which they pass to the eminentiæ mamillares at the base of the brain; this course, however, cannot be seen till a much later period of the dissection. The two posterior pillars diverge much more than the anterior, and just before the spot at which they first separate, the under part of the fornix is marked by a number of striæ, and is called *lyra* or *psalterium.* The pillars then pass down into the descending cornua of the lateral ventricles along the inner edges of the hippocampi majores, forming the tæniæ hippocampi. Below the lyra the posterior crura of the fornix not being connected, a space is left through which the pia mater enters into the ventricle forming the

VELUM INTERPOSITUM, which passes forwards, connecting the plexus choroides of each side, and covering the thalami, forms the roof of the third ventricle: to see which the velum must be turned back, but not cut off; and the thalami slightly separated. The

THIRD VENTRICLE, *Processus fissuræ medianæ perpendicularis,* will then be seen situated between the thalami nervorum opticorum. It is a fissure only, but of considerable extent from before to behind. It is of irregular figure, but deeper before than behind. At its fore part are seen the anterior pillars of the fornix, with the *anterior commissure* before them; and behind, the *posterior commissure;* in the middle, and a line's breadth below the upper and inner edges of the thalami, is the *soft commissure,* which is shown by separating the thalami. The passage between the anterior and soft commissures is called *foramen commune anterius,* and that between the soft and posterior commissures, the *foramen commune posterius.* Tear through the soft commissure, and look into the bottom of the ventricle, anteriorly see the passage called *iter ad infundibulum;* and posteriorly an opening which is the entrance of a passage called the *iter a tertio ad quartum ventriculum,* from its forming a communication with the ventricle of the cerebellum.

The floor of the third ventricle is formed by the cineritious substance anterior to the crura cerebri, by the eminentiæ mamillares, and by the infundibulum, into which it is continued. Its anterior surface is formed by

a thin cineritious lamina, the anterior pillars of the fornix, and the anterior commissure; its roof, by the body and posterior pillars of the fornix, and the posterior bend of the corpus callosum, or rather by the velum interpositum; its sides, by the thalami nervorum opticorum. It is divided into an upper and lower part by the commissura mollis.

With respect to the Commissures the following circumstances may also be noticed:

1. COMMISSURA MOLLIS. Is a process of soft cineritious substance, which passes across the ventricle, and connects the thalami nervorum opticorum.

2. COMMISSURA ANTERIOR. Is a bundle of medullary substance, of a rounded figure, somewhat flattened from above to below, covered by membrane. It is situated immediately before the anterior pillars of the fornix, at which part its middle is seen to lie straight across; but it is then continued into the fore and under part of the corpora striata, and in its passage spreads and becomes thinner, forms an arch, of which the convexity is forwards, and passing through the corpora striata without mixing with its substance, spreads in a radiated manner.

3. COMMISSURA POSTERIOR. Is a small transverse band of medullary substance at the upper and back part of the third ventricle, above the iter a tertio ad quartum ventriculum.

Proceed with the dissection by cutting longitudinally through the junction of the corpus callosum with the beginning of the posterior pillars of the fornix, and turn them and the hippocampi majores to each side. The entrance of the pia mater at this part into the lateral ventricles will then be distinctly seen. Remove the pia mater carefully, and expose the pineal gland and corpora quadrigemina.

PINEAL GLAND, *Conarium*. Is a small body, ovoid, placed upon the corpora quadrigemina, and of a dark cineritious colour. It is connected by means of two peduncles with the thalami, being placed between their posterior extremities, but at a little distance from them. The *peduncles* are two narrow medullary bands, which are continued distinct upon the inner and upper edges of the thalami, till they are lost upon it near the anterior pillars of the fornix.

From its base is continued a lamina of matter, which turns forwards, and is continued with the substance which connects the nates, and has been already mentioned as the *posterior small commissure.* The pineal gland is firmer in texture than cineritious substance generally. Within it, but not always precisely in the same place, is found a yellow hard semitransparent substance made up of rounded grains, called by Soemmering *acervulus cerebri*. It is said to be found in subjects from six years of age upwards; to be of the same composition as the earth of bones; its quantity least in young subjects and in age; and not at all connected with disease of the brain: on the contrary, Wenzel observes, that in four cases of insanity its quantity was very small.

CORPORA QUADRIGEMINA, *Bigemina, nates et testes.* Consist of four rounded projections, separated by a cruciform furrow. The upper and anterior, which are the larger, are called *nates;* the lower and posterior, *testes.* They are situated between the posterior extremities of the thalami, below the pineal gland, anterior to the cerebellum, and above the crura cerebri. They are internally composed of cineritious substance (rather reddish,) which is surrounded by a thin layer of medullary matter, through which the cineritious appears.

The Thalami, Corpora Striata and Tæniæ can now be more minutely examined.

THALAMI NERVORUM OPTICORUM. *Ganglia postica, corpora striata posteriora, colliculi.* Are on their exterior white from the medullary structure at this part. Seen in the lateral and third ventricle, and on the exterior of the brain. They are of a rounded figure, larger behind than before; anteriorly they are lengthened, become narrower, and converge. They are placed before the corpora quadrigemina, and surround the crura cerebri. On the outer side they are united by a continuation of medullary substance with the hemispheres, and with the corpora striata. The upper surface is rounded, and seen in the lateral ventricles. The inner surface is seen in the third ventricle; on it is a medullary ridge, or line, formed by the elongation of the peduncle of the pineal gland. Below this the thalami are flattened, greyer, and contiguous. Behind they are unconnected, but before are united by the commissura mollis; which is occasionally wanting, and sometimes double. Below, the thalami are mediately united by the floor of the third ventricle. The posterior surface is also rounded, and divided into three eminences: the posterior and largest is called *tuberculum posterius.* The other two, situated anterior to it, are distinguished by the names *tuberculum externum* et *internum,* vel *corpora geniculata externa* et *interna.* The two inferior are connected, by medullary bands, with the corpora quadrigemina; they are externally medullary, internally of medullary and cineritious substance mixed; inferiorly they are continued into the roots of the optic nerves. The thalami inferiorly having been continued around the crura, form the *tractus opticus,* which terminates at the union of the optic nerves.

The upper and posterior surface of the thalami is covered by a thin layer of medullary substance: the inner surface is cineritious. It is internally made up of medullary and cineritious substance mixed, being composed of layers, the rays of which run from within to without, and become interwoven with the substance of the crura cerebri.

CORPORA STRIATA. *Ganglia antica.* Occupy the greater part of the lateral ventricles, and under part of the anterior lobes. A considerable part of their upper and inner circumference is seen, forming the floor of the anterior cornu of the lateral ventricles, being broad before and narrowing hindward, and becoming arched. From the outward edge the medullary substance passes perpendicularly upwards, to form the side and upper part of the lateral ventricle.

The corpora striata are made up of alternate layers of medullary and grey substance, which are bent upwards in the same direction as the surfaces.

TÆNIA SEMICIRCULARIS, *Striata, stria cornea, geminum centrum semicirculare.* In the groove between the corpora striata and the thalami there is a medullary band on each side, of small size. It begins near the foramen Monroianum, where it is connected with the anterior pillar of the fornix. After having passed around the corpus striatum, it is continued along the roof of the inferior cornu of the lateral ventricles, and is lost towards its extremity.

Having examined the Cerebrum thus far, proceed to remove the brain from the cranium. For this purpose raise the fore part of the brain and incline it backwards, and you will expose two pairs of nerves which must be divided: 1. The *olfactory*. 2. The *optic;* the junction of which will be seen upon the processus olivaris of the sphenoid bone; and immediately behind it is seen the infundibulum passing from the third ventricle to the pituitary gland, which rests in the sella tursica. Cut through the anterior attachments of the tentorium to the superior angles of the petrous portions of the temporal bones, and proceed to divide the other nine pair of nerves. 3. The *common oculo muscular*. 4. The *inner oculo muscular*. 5. The *trigeminal*. 6. The *outer oculo muscular*. 7. The *auditory*. 8. The *facial*. 9. The *glosso pharyngeal*. 10. The *pneumo gastric*. 11. The *sublingual*. The *accessory nerve* is divided also at the same time with the 9th and 10th pairs. Pass the knife down deeply into the spinal canal, and divide the spinal marrow. After which the brain is to be carefully removed, and laid upon a table with the under surface turned upwards, in order to examine the parts there situated.

INFERIOR SURFACE OF THE CEREBRUM.

In order to examine the base of the brain, the tunica arachnoides and pia mater should be carefully dissected from it, the former of which is here very loose and distinct. At the sides each hemisphere is seen to be divided into three lobes (some reckon two:) an *anterior*—a *middle*, divided from the anterior by the *fissura Sylvii*—and a *posterior* resting upon the tentorium, but there is not any distinct separation between it and the middle lobe. In the middle is seen a diamond-shaped space, bounded before by the junction of the optic nerves, and behind by two large bodies, the *crura cerebri* which disappear at the front of a large protuberance, the *pons Varolii*. In this space are seen in front the *infundibulum*, behind which and on each side are two little projecting bodies, the *eminentiæ mamillares*, and in the space between them and the crura cerebri is the *pons Tarini.*

Crura Cerebri. Are situated immediately before the pons Varolii. Are two bodies, externally medullary, of a rounded figure, diverging and enlarging as they extend forwards: below they are separated by a fossa of some depth and breadth: this fossa forms the floor of the *Aquæductus Sylvii.* Its under surface is cineritious and perforated by numerous vessels, and hence called *Pons Tarini,* or *substantia perforata.* The crura are covered anteriorly by the junction of the optic nerves, posteriorly by the pons Varolii. The crura are composed externally of a layer of medullary matter, under which is a layer of *dark* substance, called the *locus niger.*

Eminentiæ Mamillares (medullares, candicantes, albicantes.) Are two small rounded conoid bodies, situated close together between the crura. They are externally medullary, and internally cineritious. They form the extremities of the anterior pillars of the fornix.

Infundibulum and Pituitary Gland. The *infundibulum* is, as the name expresses, a narrow funnel-shaped body, which extends from before the eminentiæ mamillares downwards and forwards, and terminates in the glandula pituitaria: so called, but the glandular nature of which is at least problematical. This is placed in the sella tursica, and covered by the dura mater, through an opening in which the infundibulum becomes connected with it. The infundibulum is somewhat narrowed in the middle, and is composed of cineritious substance. It is not always distinctly hollow; but air may be blown from the pituitary gland into the third ventricle, but not always in the contrary direction. The pituitary gland is an oval, having its long axis from side to side; it consists of an anterior and posterior lobe. It is firm in texture. In this gland likewise a gritty matter is sometimes found.

Anteriorly to the infundibulum and pituitary gland are the *optic nerves,* the roots of which extend over the crura and bottom of the third ventricle, from which they receive filaments, and become united at this part.

The rest of the under surface does not present any remarkable appearance. The surface of the lobes have the same structure externally as that of the cerebrum in general.

Next examine the

CEREBELLUM.

It is less than one-third of the volume of the Cerebrum. It is situated in the lower cavities of the occipital bone, under the posterior lobes of the cerebrum, from which it is separated by the tentorium. It is divided into body and crura, the former of which forms the upper and back part, and sends out the crura in front.

The Body, *corpus cerebelli,* is of a rounded figure, having its greatest breadth from side to side: its depth is greatest in the middle, and decreases towards the edges. In the middle of the *upper surface* of the body is seen the Superior Vermiform process, *processus vermiformis superior,* connecting the Lobes, *lobuli,* which are placed on each side of it; posteriorly the lobes are deeply separated by the falx minor, and through the fissure thus formed, the vermiform process is continued to the *under surface* of the cerebellum, where it is

called *processus vermiformis inferior.* From the fore part of the cerebellum pass out the

CRURA CEREBELLI, each of which is divided into three portions.

1. *Processus e cerebello ad testem,* which passes up on the side of the iter a tertio ad quartum ventriculum to the testes, and forms the lateral boundary of that canal.

2. *Processus e cerebello ad pontem,* which passes forwards to the pons Varolii. And

3. *Processus e cerebello ad medullam oblongatam,* which passes down to the medulla oblongata.

These three portions are not very distinct as they are merely divided by a furrow; but they are best seen by raising one of the lobes from the pons Varolii.

Next proceed to raise the posterior part of the lobes from the medulla oblongata, which is situated beneath the cerebellum, and they will be found to be connected by a thin membrane, which is part of the tunica arachnoides. Divide the membrane, and look upwards into the

FOURTH VENTRICLE: But it is better seen by making a perpendicular section from before to behind through the superior vermiform process, which must be continued also through the inferior: it will then be found to be of a triangular shape with its base in front, and the apex behind, and at the lowest angle is seen the beginning of the *calamus scriptorius.* A perpendicular section of the lobes of the cerebellum produces the appearance called *arbor vitæ,* and a transverse section that called *corpus rhomboideum;* both of which depend upon the disposition of the cineritious and medullary substance.

Between the cerebrum and cerebellum is seen a large white mass called the

ISTHMUS CEREBRI, which is formed below by the pons Tarini and crura cerebri, on the sides by the processus è cerebello ad testes, and above by a thin medullary layer, called Valvula Cerebri, which is expanded between the testes, and the anterior part of the superior vermiform process, the latter of which slightly overlaps it. This isthmus is perforated by a canal, called ITER A TERTIO AD QUARTUM VENTRICULUM, which is the communication between the cavities of the cerebrum and the cerebellum.

MEDULLA OBLONGATA.

Situated before and below the cerebellum, and resting upon the lower part of the basilar process of the occipital bone. It is usually examined after observing the under part of the cerebrum, and is seen below the pons Varolii: it is broader above than below, and from its lowest part commences the Medulla Spinalis. In the middle in front, it has the two anterior pyramidal bodies, *corpora pyramidalia anteriora,* which have their bases above, are compressed where they join with the pons, and are separated from each other by a groove. On each side of these, and separated also by a groove, are the olive-shaped bodies, *corpora olivaria;* and above them are seen the cord-like bodies, *corpora restiformia.* If the cerebellum be removed, between the corpora restiformia will be seen the posterior pyramidal bodies, *corpora pyramidalia posteriora,* which are immediately below the fourth ventricle, and separated by a groove, which being broad above and narrow below, is called *calamus scriptorius,* the shoulders of which join with the fourth ventricle, and the nib, *crena,* with the posterior fissure of the spinal marrow. The

PONS VAROLII, *Tuber annulare.* In the common mode of description is said to be composed of two crura from the cerebrum, two from the cerebellum, and two from the medulla oblongata, which are connected together by transverse medullary fibres, embedded in cineritious substance: the white substance is placed on the exterior of the crura and pons, and if it be scraped off, the darker cineritious substance is exposed, forming the appearance called *locus niger.*

ORIGIN OF THE CEREBRAL NERVES.

The number of these nerves has been variously estimated from different views of the division of the brain, and from considering some nerves now as separate, now as parts of others. There may be said to be eleven pair. 1. *Olfactory.*—2. *Optic.*—3. *Common oculo-muscular,* or *Motores oculorum.*—4. *Inner oculo-muscular,* or *Pathetici.*—5. *Trigeminal.*—6. *Outer oculo-muscular,* or *Abducentes.*—7. *Auditory.*—8. *Facial.*—9. *Glossopharyngeal.*—10. *Pneumo-gastric,* or *Par vagum.*—11. *Lingual.*

1. OLFACTORY, *Nerv. olfactorius, par primum.* Is situated in a groove on the anterior lobes, near to their inner edge. It arises by three roots of medullary matter from the inner and back part of the under surface of the anterior lobe, where it joins with the middle lobe. The nerve runs forwards, over the sphenoid bone and cribriform plate of the ethmoid bone, inclined to the opposite nerve. It gradually enlarges and forms a bulbous extremity, *bulbus nervi olfac-*

torii, from which nerves go to the nose. It is composed of medullary and cineritious fibres intermixed.

2. Optic, *Nerv. opticus, par secundum.* Arises by a broad flat beginning from the back part of the outer and upper surface of the thalamus and corpora quadrigemina, being connected more especially with the testes. The nerve is continued forwards and inwards over the inferior surface of the crus cerebri to which it is attached; it becomes in its course narrower, thicker and rounder; and joins with the other optic nerve, at an obtuse angle immediately under the third ventricle, with the bottom of which it is connected by fibres. The optic nerves from their origin to this part form the *tractus opticus*. The nerves then separate and diverge to pass through the optic foramina.

Concerning the manner of their junction there still subsists a variety of opinion: viz. 1. That they are only contiguous; 2. Or that they completely cross, a decussation taking place, so that the right passes to the left, the left to the right side; 3. Or that the decussation is only partial. The first opinion is supported by the fact that the outer fibres have been found to pass on to the same side, and that no decussating fibres can be discovered in the middle; that two cases have been met with, in which no union was traced; and that in blindness, with consequent decrease of the nerve, the diminution has been continued behind the place of junction on the same side. The second opinion is supported by the alleged observation of several anatomists; by cases where a small optic nerve, without disease beyond the place of junction, has reappeared as a small nerve behind the place of junction on the opposite side; by cases of disease where the opposite nerve has been affected behind the junction; by some cases where the disease has been at the origin of one nerve, and the opposite eye affected; and by analogy with the optic nerves of fish, in which a complete decussation is evident. Nor is the third opinion unsupported by anatomical examination and by pathological observations, in which the affection has been continued on the same side through the external fibres, to the opposite side by the internal fibres, or where in the affection of one eye and nerve, both nerves have been affected behind the place of junction. The necessary inference from these observations, supposing them correct, is, that the junction is taking place in different individuals in the three different modes above enumerated. But it is probable that in the greater number of instances the mixture of fibres is more or less partial. At the same time it may be remarked that the decrease of the nerve behind the place of junction cannot amount to a proof; as where blindness has continued for a length of time in both eyes, one nerve has been found much smaller than the other.

3. Common Oculo-muscular, *Nerv. oculo-muscularis communis, motor oculi, par tertium.* Comes off close to the anterior edge of the pons Varolii, from the inner surface of the crus cerebri. But its origin may be traced higher through the cineritious substance by a fasciculus, the anterior part of which reaches to the depression between the

crura; the posterior to the bottom of the aqueduct. It is continued through the outer wall of the cavernous sinus, first above and then under the ophthalmic branches of the trigeminal nerve, and passes through the foramen lacerum orbitare.

4. Inner Oculo-muscular, *Nerv. oculo-muscularis internus, superior, patheticus, par quartum.* Is the smallest of the cerebral nerves. It arises immediately behind the testes from the processus ad testes. The nerve then proceeds downwards and forwards, over the crus cerebelli before the edge of the pons Varolii, over the crus cerebri, is continued along the under surface of the brain, passes near the posterior clinoid process into a sheath of dura mater by which it is separated from the cavernous sinus, communicates by one thread with the first branch of the fifth, between which and the motor oculi it is placed, and then passes through the foramen lacerum into the orbit.

5. Trigeminal, *Nerv. trigeminus, par quintum.* It makes its appearance between the pons Varolii and crus cerebelli. It may be traced towards its source from the part where it makes its appearance through the crus cerebelli upwards and backwards, to the depression between it and the corpus olivare, and takes its origin from both of these. In the first part of its course the fibres are not distinct, and it is surrounded by cineritious substance. It gradually enlarges at the part where it appears at the base; is flattened, but becomes rounder and smaller; then spreads in passing to the edge of the petrous portion of the temporal bone, along which it is continued forwards in a sheath of dura mater which separates it from the cavernous sinus. Upon the anterior part of its surface it is enlarged, and forms the *semilunar ganglion*, which for the most is of a homogeneous structure, like the ganglia, having its convexity anteriorly and inferiorly, where becoming again fibrous, it passes off in three principal branches. 1. The *ophthalmic*, or superior branch, the smallest, is continued along the outer and under part of the cavernous sinus to the orbit through the foramen lacerum. 2. The *superior maxillary*, the middle in size and situation, passes forwards to the foramen rotundum. 3. The *inferior maxillary*, the largest, from the lower and back part, passes downwards and outwards to the foramen ovale.

6. External Oculo-muscular, *Oculo muscularis externus, abducens, par sextum.* It arises from the upper end of the corpus pyramidale and posterior edge of the pons Varolii. It sometimes arises alone from the corpus pyra-

midale or olivare. It passes outwards and forwards, and takes its course opposite to the posterior clinoid process through the dura mater into the cavernous sinus, from the blood in which it is separated by the internal membrane. It has on the inner side the carotid artery, with which it is connected; and sends some filaments to the sympathetic nerve, and on the outer side the opthalmic branch of the trigeminal nerve, and is continued through the foramen lacerum.

7. AUDITORY, *Portio mollis, auditorius, acusticus, par septimum.* Is so named from its soft texture, but is more firm than the olfactory. Arises by the white filaments of the calamus scriptorius, and from the lateral surface of the crus of the cerebellum, just above the nervus vagus. It passes over the edge of the crus cerebelli with which it is intimately connected. Its inner surface is hollowed for the reception of the portio dura. At its origin it is soft and not distinctly fibrous; but becomes so on leaving the brain. The nerve passes into the meatus auditorius internus, along which it is continued.

8. FACIAL, *Portio dura, communicans faciei, sympatheticus minor.* Is smaller than the portio mollis, arises from the portio mollis, which receives it in a groove, from the posterior edge of the pons Varolii and from the crus cerebelli. The nerve passes from the side of the middle of the pons forwards and outwards to the auditory foramen, is continued through its canal with the portio mollis, then quits it and takes its course through the stylo mastoid canal.

9. GLOSSO-PHARYNGEAL, *Nerv. glosso-pharyngeus.* Arises by five or six threads between the nervus vagus and facial nerve, close to the former; from the under surface of the crus cerebelli, from the depression between it, the corpus olivare, and the posterior edge of the pons Varolii, from which it receives sometimes a filament or two; takes its course outward, and at first forward, and is connected by a strong branch with the pneumo-gastric nerve. It passes into a separate sheath of dura mater, and is continued through the fore part of the foramen lacerum basis cranii, at the beginning of which it forms an oval ganglion.

10. PNEUMO-GASTRIC, *Nerv. vagus, nerv. pneumogastricus, &c.* Arises from the under and lateral part of the crus cerebelli, and from the groove between it and the corpus olivare, by from ten to sixteen filaments, receiving some few from the corpus olivare. These filaments converge into a flat trunk, which takes its course in a short sheath

of dura mater through the fore part of the foramen lacerum, separated by a long process of bone from the internal jugular vein, and by dura mater from the nervus accessorius & nerv. glosso-pharyng. and in the canal it becomes rounded.

11. LINGUAL, *Nerv. lingualis, sublingualis, hypoglossus, &c.* Arises by four to eight filaments from the anterior surface of the medulla oblongata, and from the groove between the corpus olivare and corpus pyramidale. It forms two or three fasciculi which pass separately through the dura mater into the foramen condyloideum anterius, and are united at its outlet into a single trunk.

MORBID APPEARANCES WITHIN THE CRANIUM. Processes of bone from the cranium. OF THE MEMBRANES: Inflammation — Adhesion — Effusion — Suppuration — Ulceration — Gangrene — Excrescences — Hydrocephalus externus — Ossification of dura mater — Thickening of tunica arachnoides — Ossification of pia mater. OF THE BRAIN: Effusion of blood or serous fluid into its substance — Effusion of serous fluid into the ventricles — Hydrocephalus internus — Tumours in brain — Abscesses — Substance of brain very soft or very firm — Hydatids of plexus choroides.

SPINAL MARROW.

The Spinal Marrow is enveloped by the same membranes as the brain.

DURA MATER. Forms a complete canal throughout the cavity of the vertebral column. It becomes gradually more capacious as it descends, and terminates at the under part of the sacrum in a cul de sac. The bag of the dura mater is smaller than the vertebral canal, especially laterally and posteriorly, and is at these parts attached to it by a loose cellular texture which contains, especially below, a considerable quantity of a reddish yellow fat-like substance; anteriorly it is closely connected with the vertebræ. It furnishes sheaths for the nerves, each sheath being continued with its nerves through its foramen, and is then gradually lost. Its fibres are more regularly arranged, but more delicate and less distinct than in the cranium.

TUNICA ARACHNOIDES. Is disposed in the same way as in the cranium, and is loosely connected with the piamatral covering.

PIA MATER. Is thick, of a close and firm texture, which increases downwards. It is closely adapted to the spinal marrow. It is yellowish white. Its external smooth

surface is not connected with the tunica arachnoides. It terminates below in a single cord, which passes between the nerves of the cauda equina, and is united below with the dura mater. It has an anterior and a posterior production or appendix, of which the former is the most distinct, which are continued into the corresponding fissures of the spinal marrow.

LIGAMENTUM DENTICULATUM, *Serrated membrane.* Is a narrow thin membrane, placed between the pia mater (of which it is considered by some anatomists as a process) and the tunica arachnoides on each side of the cord. Its inner border is straight and connected with the pia mater; its outer one presents a series of angular projections or teeth, about twenty in number, which are firmly attached to the dura mater; they are small dense strong cords, which pass in the spaces between the nerves. The membrane begins at the top of the cord and reaches to the extremity of the dorsal portion. It appears to have a tendinous structure. We now proceed to the Spinal Marrow itself.

SPINAL MARROW, *Chorda spinalis.*

Begins at the foramen magnum from the medulla oblongata. It is of a cylindrical figure. It may be divided into a cervical and dorsal portion. In its descent through the cervical vertebræ, it enlarges and again contracts, becoming as it enters the canal of the vertebræ dorsales somewhat smaller than above the enlargement. At the last dorsal vertebra it begins again to enlarge, but less considerably, and terminates in a blunt extremity, nearly opposite to the first lumbar vertebra, where it is divided into several cords. It is much smaller than the vertebral canal. It is divided into two lateral halves by an anterior and posterior fissure, *fissura medullæ spinalis mediana anterior et posterior,* which are extended along the whole anterior and posterior surfaces of the medullary substance. The anterior is the more considerable; but neither penetrate to the cineritious interior.

The spinal marrow is composed of cineritious and medullary substance. The cineritious situated within and the medullary without.

The spinal marrow is made up of two lateral double columns, which ascend parallel to each other, connected anteriorly and posteriorly by a lamina of medullary substance. The posterior columns continue their course: while the anterior decussate at the upper end of the spinal marrow, so that the right becomes left, and the left right. Here the anterior fissure is interrupted for about five lines. The decussation takes place by means of from three to five fasciculi, into which the anterior and posterior portions separate; whilst the lateral portions pass directly upwards.

NERVES OF THE SPINAL MARROW.

There are *thirty-one* pair, including the *accessory* and the *sub-occipital* nerves, which arise from the spinal marrow. They are divided into *cervical, dorsal, lumbar,* and *sacral.* They arise by a double root, an anterior and a posterior, from the corresponding surfaces of the medulla; the posterior roots are the larger, they arise nearer the middle, and are composed of fewer not so distinctly fibrous filaments as the anterior. The two sets of roots are separated by the ligamentum denticulatum; but unite at the part where the nerves pass through the dura mater. Before this, their passage through the dura mater, filaments of communication may be seen between several of the pairs. Shortly after, the posterior root becomes enlarged in the form of a ganglion, with which the anterior does not communicate.

SUMMARY ACCOUNT OF THE DISSECTION OF THE SPINAL MARROW AND BRAIN,

According to Drs. Gall and Spurzheim.

The nervous system is composed of a plurality of parts, all of which, however, are in communication with each other; thus we have the nervous systems of the belly and chest, that of the spinal marrow, and that of the brain. The Spinal Marrow and Brain only, however, it is here intended to notice.

The nervous mass, usually described as the

MEDULLA SPINALIS,

Consists of two parts, the *grey* and *gelatinous substance,* which is found in the interior of its whole length, and the *nervous fibres* from which the white substance of the nervous system of the vertebral column is formed, and which are situated on the exterior. When the dura mater and tunica arachnoides have been cut through, and the spinal marrow removed from its canal, if it be held up, numerous gangliform enlargements will be seen on each side, giving to it an undulated appearance at the points whence the nerves seem to arise.

It terminates below about the second lumbar vertebra; where may be seen two little knots or ganglia, of which the lower is small and conical, and the upper large and oval. Above, it is said to terminate at the foramen magnum, immediately above which it is much increased in size to form the enlargement known as the *medulla oblongata.*

The Spinal Marrow is divided into two columns, by an *anterior* and *posterior fissure,* which extend perpendicularly through its whole length; of these the former is the broadest and the most distinct, but the latter is the deepest; which may be seen by making a transverse section. Two *collateral fissures* are also seen, one on each side of the posterior fissure, which passing down from the upper part, are lost opposite the first dorsal vertebra. When the vascular tissue is removed, the nervous fibres in the anterior fissure will be seen, running in a direction parallel to the lateral edges of the spinal marrow; while those in the posterior pass perpendicularly from the surface to the bottom of the fissure. The anterior fissure is also further distinguished by the decussation of the fibres of the pyramids at the beginning of the medulla oblongata.

The columns are joined at the bottom of the fissures by a layer of nervous matter, forming a *commissure;* on the posterior part of which, two longitudinal bands pass down; and on the anterior numerous little transverse bands run across towards each other, but do not join, their points being received between each other like the points on the crowns of the teeth. The grey substance is deposited in each column in form of an arched layer, with its concavity outwards, having one of its points before, and the other behind; from each of these arise bundles of nerves, so that there are anterior and posterior nerves; the former of which have been proved by Majendie to be nerves of voluntary motion, and the latter of sensation. The small nerves of each enlargement having passed through the dura mater, a ganglion is formed by the posterior bundles which are the largest, to which the anterior are firmly attached, but without being intermixed.

Within each portion of grey substance a *canal* may be found extending through the whole length of the spinal marrow, which is easily shown by throwing in air with a blow-pipe; they pass up through the medulla oblongata, the pons Varolii, under the tubercula quadrigemina, and through the peduncles as far as the thalami nervorum opticorum, in which they form *cavities* that may be inflated to the size of an almond, and are bounded before by the junction of the thalami with the corpora striata; but no communication between them and the ventricles has yet been discovered.

The great nervous mass situated above the foramen magnum, and generally known as the

MEDULLA OBLONGATA.

Besides containing the corpora pyramidalia and olivaria, has also the origins of the fifth, sixth, and seventh pairs of nerves, and the commencement of the cerebellum and cerebrum. It is in close connection with the spinal marrow, and has like it the fissures, commissure, internal grey substance, and canals.

On the fore part are seen the anterior pyramids, *corpora pyramidalia anteriora*, narrow below, and broad above, where they pass through the pons Varolii, and separated from each other by the anterior fissure of the spinal marrow: on their sides are seen the olives, *corpora olivaria*, of an olive-shape; further outwards the cords, *corpora restiformia*, from their resemblance to a cord, and on the posterior surface between the cords are seen the posterior pyramids, *corpora pyramidalia posteriora*, which are found in the fourth ventricle, and separated by the calamus scriptorius or termination of the posterior fissure of the spinal marrow.

THE BRAIN

Is divided into two principal parts; the anterior superior, composed of the two hemispheres, and called CEREBRUM; and the posterior inferior close to the medulla oblongata, from which the greater number of the cerebral nerves arise, called the CEREBELLUM on account of its smaller size. We begin with the

CEREBELLUM.

From the grey substance within the medulla oblongata, commence a number of nervous roots, which are the *primitive fibres* of the cerebellum; they collect together on each side, forming the corpus restiforme.

CORPORA RESTIFORMIA, *Processus è cerebello ad medullam oblongatam.* Each corpus restiforme is similar in shape to a small cord; it passes upwards, and in its course increases in size, having before it the facial, and behind it the auditory nerve and its grey substance or ganglion, which must be gently scraped off with the handle of a scalpel. The fibres of the corpus restiforme being followed, a distinct bundle is seen entering into the hemisphere of the cerebellum, where it is surrounded by a layer of grey substance, which, having an irregular tooth-like form, has led to the designation,

corpus dentatum vel rhomböideum; and the connection between these parts is so firm, that it is impossible to follow the fibres further.

This grey substance is to be considered a *ganglion*, as it answers that purpose; numerous fibres being sent off, which increase the size of the nervous mass, and ramify in different directions. One principal bundle of fibres passes towards the mesial line, and meeting with that from the opposite side, forms the median part of the cerebellum, *processus vermiformis*, which is separated into seven distinct branches; and these may be seen by making a perpendicular section. This is the *primitive* or *fundamental* part of the cerebellum, and is found either of larger or smaller size, in all animals possessing a brain.

The rest of the fibres, in form of leaves, pass in different directions, and are covered externally by grey substance; a perpendicular section shows this disposition, and forms the *arbor vitæ.*

A perpendicular incision through the middle of the ganglion shows eleven branches, and this number is increased or diminished as the incision is nearer or farther from the centre; the incision is to be made from the point at which the corpus restiforme first enters, and in the course of its fibres, so that one-third of the cerebellum is on the inner and two-thirds on the outer side: if it be made farther out, the cineritious substance or ganglion is either much diminished or entirely deficient.

COMMISSURE OF THE CEREBELLUM, or *Pons Varolii.* Another order of fibres, which are called *transverse, converging* or *returning*, originate from the surface of the grey substance, without having any immediate connection with the ganglion of increase, or with the primitive bundle: they pass in different directions between the diverging fibres, the anterior bundles transversely before the anterior pyramids, and the posterior and median above them: at the mesial line they join with similar bundles from the opposite side, and form the pons Varolii. This commissure serves to connect the two hemispheres of the cerebellum.

But besides this commissure, there are other fibres which connect the superior part of the posterior pyramids with the lower portion of the fundamental part of the cerebellum, and others which connect the upper portion of the fundamental part with the nervous mass in the neighbourhood of the corpora quadrigemina. And thus the parts of the same side are connected with each other. The space between these ascending fibres, is called the *calamus scriptorius*, or *cisterna cerebelli*, within which are seen the origins of the auditory nerves, in shape of bands.

OF THE CEREBRUM.

The Cerebrum consists of a number of primitive bundles, which are formed of the grey substance in the medulla oblongata; they pass up through the commissure of the cerebellum to the thalami nervorum opticorum and corpora striata, which are specially considered as *ganglia*, and described as the GREAT INFERIOR and GREAT SUPERIOR GANGLIA OF THE CEREBRUM. From these, in their passage, they acquire an increased number of nervous fibres, are expanded to form the convolutions, and being covered by the grey substance, derive from it also additional fibres. These fibres, from their course, are called the *longitudinal, diverging or departing fibres;* or, from the constant increase which takes place in them, the *apparatus of formation.*

The *primitive bundles* may be enumerated as the anterior and posterior pyramids; the bundles from the corpora olivaria, the longitudinal fibres which assist in forming the fourth ventricle, and some others which are hidden in the medulla oblongata. All these fibres originate on the same side as that in which they form part of the cerebrum; with the exception of the anterior pyramids, which decussate, the fibres on the left side, passing over to the right, and those on the right passing to the left side of the cerebrum.

The ANTERIOR PYRAMIDS. *Corpora pyramidalia anteriora.*

These are two in number, rather more than an inch in length, situated in front of the medulla oblongata, and separated from each other by the continuation of the anterior fissure of the spinal marrow; and soon after their formation they send off four or five little cords or threads which pass between one another to the opposite side, and as they rise up on the fore part of the medulla oblongata increase in size, so that when they approach the annular protuberance *(pons Varolii)* they are broader than at their origin, which has given rise to their name, *pyramids.*

To show the decussation, it is only requisite to remove carefully the pia mater from the pyramids, and turning aside the two edges of the anterior fissure, the decussation will be immediately seen, the fibres from the right crossing to the left, and those of the left to the right side, forming a kind of interlacing like a straw-plait. As the pyramids pass up

they send a few fibres to the corpora olivaria; and immediately before they appear to join with the annular protuberance, become slightly contracted, and seem to terminate. This, however, is not the case, for each pyramid may be traced through the annular protuberance, and appears at the upper edge as the crus cerebri, of which it forms the two anterior thirds, having increased very much in size during its passage through that part.

To show the passage of the pyramids through the commissure of the cerebellum. Make a perpendicular incision through the front of the commissure, about a line in depth, and follow up the pyramids towards the crus cerebri, in a curved direction, having the concavity outwards, and with the knife turn the transverse fibres of the commissure to each side; the pyramids will then be seen expanding into numerous bundles immediately after its entrance into the commissure, which are increased by the addition of other filaments, produced by the great quantity of grey substance in which they are embedded: the fibres mount upwards, and are either disposed in layers, or are crossed at right angles by the transverse fibres of the commissure. Having become thus enlarged, they pass out from the upper edge of the commissure as

THE GREAT FIBROUS BUNDLES OF THE HEMISPHERES. *Crura cerebri.*

These, in their passage forwards and upwards, increase in size by the addition of new fibres, which are produced by the grey substance contained within them; but it is at their superior part, where the great bundle is crossed by the optic nerve, and is joined to it by a soft band, that there is the greatest increase of nervous fibres. These fibres are continued onwards, and expand into numerous layers, which being covered at their extremities with grey substance, form the parts at present known as the *convolutions.* The expansion of the pyramids thus form the inferior external and anterior convolutions of the anterior and middle lobes of the cerebrum.

In order to complete the Great Bundles, next trace

THE OLIVES. *Corpora olivaria.* These bodies, two in number, are situated one on each side of the outer edges of the anterior pyramids, from which they are separated by a groove, and extend up to the inferior edge of the commissure of the cerebellum. From each is sent out a bundle of fibres, which, like the anterior pyramids, pass up through the commissure, in their course through it are increased in size, and at the upper part form the posterior and inner third of the Great Bundle, where they receive a further addition.

The great fibrous bundle being thus formed passes up into

The Great Inferior Ganglion. *Thalamus nervi optici.* In which its fibres meet with a large quantity of grey substance, and are again increased by new fibres; but all the fibres are here very minutely divided. They ascend to the superior edge of the ganglion, again collect into bundles, and diverging in form of flames or rays enter

The Great Superior Ganglion. *Corpus striatum.* This is a large mass of grey substance, part of which is placed in the lateral ventricle of each side, and part on the external surface of the cerebrum, where it is covered by some short convolutions. In this grey mass the fibres are again increased, and to such extent, that they are sufficient to form the posterior, and all those convolutions which are situated on the superior edge of each hemisphere; and having thus been increased, they spread out and form the convolutions.

To show the passage of the fibres through the ganglia.

On the external surface,

Raise the optic nerve from its connection with the great bundle, and cut off thin slices of the under surface of the cerebrum, towards the fissura Sylvii, which will show the passage of the nervous fibres through the ganglia to the internal and inferior convolutions of the middle and anterior lobes of the cerebrum.

Tear open the floor of the third ventricle, cut through the commissure of the cerebellum and between the anterior pyramids, turn each of the great bundles to the outside, and expose

The internal surface.

Slice off the superior ganglion, *corpus striatum,* and see how the fibres pass through it towards the forehead in numerous small bundles, and backwards towards the posterior lobe of the cerebrum, where they are larger.

Commissures of the Cerebrum.

The similar parts in each hemisphere are connected by a number of nervous fibres, which, like those of the cerebellum, *pass transversely, converge,* and *re-enter;* but it is doubtful whether they arise from the grey substance. These fibres are stronger and more distinct than those of the diverging fibres,

between which they pass at the bottom of all the convolutions and form a firm tissue.

The circumvolutions of the whole posterior lobe, and the posterior part of the middle lobe, are folded behind the great fibrous bundle, *(crus cerebri,)* and the great inferior ganglion, *(thalamus opticus,)* and they pass in an oblique direction, to meet those of the opposite side in the mesial line. The posterior fibres of the middle lobe principally form the fornix; and its posterior internal fibres terminate in the posterior fold of the great commissure *(corpus callosum.)*

The uniting fibres of the anterior convolutions of the middle, and those situated at the bottom of the fissura Sylvii, are collected at the fore part of the innermost convolutions of the middle lobe, and form a band about the size of a quill, which passes from without to within, crossing before and below the outer half of the superior ganglion, *(corpus striatum,)* but without adhering to it, to the mesial line, where it joins with its fellow: these together form an arc, the convexity of which faces forwards; this is known as the *anterior commissure:* it is easily seen by slicing off the under part of the superior ganglion. Another bundle connects the posterior part of the inferior ganglion to its fellow; it is narrow and short, passes but a slight distance into the ganglia, and does not extend into the convolutions; this is the *posterior commissure:* it may be shown by slicing off the posterior upper parts of the inferior ganglia. The under part of the anterior lobes are joined before the superior ganglion by the fore part of the great commissure *(corpus callosum.)*

The superior convolutions of the cerebrum are joined by the great commissure, *corpus callosum,* but as the anterior and posterior lobes are separated before and behind, their fibres cannot pass transversely to the mesial line, but those of the anterior lobes pass backwards and inwards, and those of the posterior forwards and inwards: the greatest number of fibres, therefore, joining at the anterior and posterior folds of the commissure, is the reason why the commissure is thickest behind and before, and thinnest in the middle.

All the cerebral parts then are engendered, formed, and perfected in the same manner as the other nervous systems, and like them the analogous parts of each hemisphere are connected by commissures in the mesial line.

Besides the commissures which are connecting the hemispheres to each other, there are found peculiar transverse interlacements, wherever there is a great increase of nervous fibres, among the diverging fibres, this is often seen, 1st, at the base of the corpus olivare: 2d, across the middle of the crus cerebri: 3d, below the optic nerve at its outer edge: 4th, at the point of increase of the fibres forming the superior convolutions of the middle lobe: 5th, between the corpus striatum and the thalamus nervi optici, which in the ventricles is known as the *tænia semicircularis:* and 6th, at the outer edge of the corpus striatum. But what their use is, at present is undecided.

From the corpus mamillare are sent out two little bands *internally* and one *externally;* the external joins at the outer edge of the optic thalamus, with the transverse interlacing, situated below the optic nerve. The internal posterior prolongs itself internally in the mass of the optic thalamus. And the internal anterior passes across the grey substance at the junction of the optic nerve, and extends into the anterior pillar of the fornix.

To unfold the convolutions. Take off the pia mater and tunica arachnoides, pass the fingers between the great bundle and the tænia hippocampi, penetrate into the posterior and lateral cavities, at the same time pressing gently on the external surface; a slight resistance is met with at the spot where the diverging and converging fibres are connected by a tissue, which must be torn through, and in this way the convolution can be opened. The same effect also may be produced by cutting off a convolution and boiling it in oil, when the two layers will separate, leaving a cavity between them.

§ 3. OF THE PAROTID GLAND AND THE MUSCLES OF THE FACE.

The Salivary Glands consist of three pairs.

The extent and connections of the Parotid, the largest salivary gland, and its duct, are first to be traced.

Parotid Gland. Is named from its situation near the ear. It reaches from the zygomatic arch downwards to below the angle of the jaw, covering a portion of the masseter, and occupying the space between the ascending plate of the jaw-bone and the mastoid process. This, however, is merely its superficial extent; it is continued to the root of the meatus anditorius externus, adhering to the internal pterygoid muscle, is folded over the posterior edge of the masseter muscle, and lies deep seated between the ascending plate of the jaw-bone, and the mastoid process. The under edge of it is contiguous to the submaxillary gland, and is

sometimes joined with it. The *duct of the parotid* arises from the anterior margin of the gland; its course may be marked generally by a line drawn from the junction of the lobe of the ear with its pinna, to the base of the nose, and passing immediately below the malar eminence. It receives often a small duct from a corresponding glandular process situated above it on the masseter, the *glandula accessoria* of Haller. The duct continues its course in the direction just described over the anterior margin of the masseter muscle, having the middle facial nerve above it, and the transverse facial artery still higher; it descends a little, and perforates the buccinator muscle opposite the second molar tooth of the upper jaw.

The parotid has a covering of a dense cellular texture. It is of a greyish colour, and of a tolerably dense and firm texture. It is made up of a number of lobes, which are easily seen, united by cellular membrane, and these lobes are again made of other smaller ones, from which the excretory duct is arising by minute radicles.

a. PALPEBRAL REGION, containing the muscles of the eyelid and eyebrow.

1. M. ORBICULARIS PALPEBRARUM.

Situation. Surrounds the eyelids.

Origin. Fleshy from the orbitar process of the superior maxillary bone. The fibres pass downwards, then outwards, spreading over the under eyelid and upper part of the cheek; they surround the outer angle, and then run inwards over the superciliary ridge, and spread over the upper eyelid: they descend then to the inner angle, adhering to the internal angular process of the os frontis, and to a short round tendon, which is fixed to the nasal process of the superior maxillary bone, and is commonly considered as the *Insertion* of the muscle, but seems rather to connect and support the eyelids. This tendon may be perceived under the integuments, and points out the situation of the lachrymal sac.

Use. To shut the eyelids, and to press the lachrymal gland.

2. M. CORRUGATOR SUPERCILII.

Situation. Above the internal angular process, close to the bone, and covered by the last muscle.

Origin. Fleshy from the internal angular process of the os frontis. It passes upwards and outwards, and extends as far as the middle of the superciliary ridge.

Insertion. Into the eyebrow, intermixing with the orbicularis palpebrarum.

Use. To draw the eyebrow downwards and inwards in frowning; and to pull down the skin of the forehead.

b. NASAL, containing one muscle.

1. M. COMPRESSOR NARIS.

Situation. On the side of the nose.

Origin. From the root of the ala nasi, where it is connected with part of the levator labii superioris alæque nasi. Its fibres spread upon the side of the nose towards the dorsum, where it joins with its fellow.

Insertion. Into the extremity of the os nasi and nasal process of the superior maxillary bone.

Use. To compress the nostrils.

c. LABIAL, containing the muscles of the Mouth and Lips, of which there are nine pairs; viz. three above, three below, and three on the outer side; and the single muscle which surrounds the mouth.

1. M. LEVATOR LABII SUPERIORIS ALÆQUE NASI.

Situation. Superficial upon the side of the nose.

Origin. By two fleshy attachments. The first from the external part of the orbitar process; and the second from the nasal process of the superior maxillary bone.

Insertion. Of the first slip into the upper lip; and of the second into the upper lip and outer part of the ala of the nose.

Use. To elevate the upper lip and to expand the nostril.

2. M. DEPRESSOR LABII SUPERIORIS ALÆQUÆ NASI.

Situation. Within the mouth; the lip must be turned up and the membrane of the mouth removed to expose it.

Origin. Thin and fleshy from the superior maxillary bone near the roots of the incisor and cuspidatus teeth. It runs upwards.

Insertion. Into the upper lip and root of the ala nasi.

Use. To antagonize the last muscle.

3. M. LEVATOR ANGULI ORIS.

Situation. Deep, and in part covered by the lev. lab. super. &c.

"*Origin.* From the hollow of the superior maxillary bone below the foramen infra orbitare.

Insertion. Into the angle of the mouth.

Use. To draw up the corner of the mouth.

4. M. DEPRESSOR ANGULI ORIS.

Situation. On the outside of the chin.

Origin. Broad and fleshy from the outer edge of the fore and lateral part of the lower jaw. It runs over the origin of the depressor labii inferioris, becoming gradually narrower.

Insertion. Into the angle of the mouth, intermixing with the zygomaticus major and levator anguli oris.

Use. To antagonize the levator anguli oris.

5. M. DEPRESSOR LABII INFERIORIS.

Situation. Upon the chin; the posterior part of its origin covered by the last muscle.

Origin. Broad and fleshy from the under part of the lower jaw, at the side of the chin, and runs obliquely upwards.

Insertion. Into about half of the edge of the under lip.

Use. To depress the lower lip.

6. M. LEVATOR LABII INFERIORIS.

Situation. Within the mouth; the lower lip must be depressed, and the membrane of the mouth removed.

Origin. From the inferior maxillary bone near the roots of the incisor and cuspidatus teeth.

Insertion. Into the under lip and skin of the chin.

Use. To antagonize the last muscle.

7. M. ZYGOMATICUS MAJOR.

Situation. On the cheek, its fibres running obliquely from the zygoma.

Origin. Fleshy from the os malæ near its junction with the temporal bone.

Insertion. Into the corner of the mouth.

Use. To draw up the corner of the mouth.

8. M. ZYGOMATICUS MINOR.

Situation. Before the last muscle, but often wanting.

Origin. From the upper and prominent part of the os malæ.

Insertion. Into the upper lip, near the corner of the mouth.

Use. Same as the last.

9. M. BUCCINATOR.

Situation. Deep, and extending far back behind the masseter: it is crossed by the zygomatici.

Origin. Tendinous and fleshy from a ridge extending between the last molar tooth and the root of the coronoid process of the lower jaw; from the upper jaw between the last molar tooth and the root of the pterygoid process of the sphenoid bone, and from the extremity of that process. Its fibres pass straight forwards, adhering to the membrane which lines the mouth.

Insertion. Into the corner of the mouth.

Use. To draw the angle of the mouth backwards, and to lessen the cavity of the mouth, so as to thrust the food between the teeth.

10. M. ORBICULARIS ORIS, *Sphincter Labiorum.*

Situation. It surrounds the mouth, being a sphincter muscle, and forms a considerable part of the lips. It seems to be formed in a great measure by the muscles which have been just described: their fibres decussating at the corners of the mouth, and running along the lips.

Use. To shut the mouth, and to antagonize all the other muscles.

A portion of this muscle, attached to the septum of the nose, is sometimes described as a separate muscle, under the name of the *M. nasalis labii superioris.*

c. MAXILLARY, containing four muscles which elevate the lower jaw.

1. M. MASSETER.

Situation. It covers a considerable part of the side of the lower jaw, and is itself partially covered by the parotid gland.

Origin. Tendinous and fleshy from the superior maxillary bone, where it joins with the os malæ, and from the whole length of the under and internal part of the zygoma. The external part of the muscle consists of fibres which have an oblique direction backwards, and the internal part of fibres which are directed downwards and forwards. It forms a very strong muscle, of which the fleshy fibres are intermixed with tendon.

Insertion. Into the angle of the lower jaw, and into the external part of that bone upwards to the coronoid process.

Use. To shut the mouth, by raising the lower jaw.

2. M. TEMPORALIS.

Situation. On the temple: the zygomatic arch and origin of the masseter must be removed to see its insertion.

The origin and situation of this muscle have been already described. See page 146. Its insertion may now be traced.

Insertion. By a strong tendon into the coronoid process

of the lower jaw, which it encloses, and is continued nearly to the last molar tooth.

Use. To raise the lower jaw and shut the mouth.

3. M. Pterygoideus Internus.

Situation. To the inner side of the angle and ascending plate of the lower jaw; to see this and the next muscle, it is best to chisel off the coronoid process and the anterior half of the ascending ramus of the lower jaw, which exposes them without disturbing their relative situation.

Origin. Tendinous and fleshy from the internal plate of the pterygoid process of the sphenoid bone, filling up the space between the plates, and from the pterygoid process of the os palati.

Insertion. Into the angle of the inferior maxillary bone internally.

Use. To elevate the lower jaw, to bring it forward on the eminentia articularis, and to draw it obliquely to the opposite side.

4. M. Pterygoideus Externus.

Situation. On the inner side of the cervix of the lower jaw, between it and the last muscle.

Origin. From the outer side of the external plate of the pterygoid process of the sphenoid bone, from the tuberosity of the superior maxillary bone adjoining to it, and from the root of the temporal process of the sphenoid bone.

Insertion. Into the cervix of the lower jaw, and adheres to the capsular ligament.

Use. To pull the lower jaw forwards and obliquely to the opposite side: it also assists in raising the jaw.

§ 4. OF THE ACTIONS OF THE MUSCLES WHICH PRODUCE THE MOVEMENTS OF THE LOWER JAW.

The direct motions of the lower jaw are:—*downward*—*upward*, by which the teeth are brought into contact—*forward*—*backward.* The muscles therefore may be arranged as—*a.* Depressors, *b.* Elevators, *c.* Motors forward, *d.* Motors backward.

a. Depressors.

1. Digastrici.
2. Mylo-hyoidei.
3. Genio-hyoidei.
4. Genio-hyo-glossi.

For the action of these muscles the os hyoides must be fixed by other and appropriate muscles.

b. Elevators.

1. Temporales.
2. Masseteres.
3. Pterygoidei interni.
4. Pterygoidei externi.

c. Motors forward.

1. Pterygoidei Externi, assisted at the commencement of their action by the pterygoidei interni, and part of the temporales and masseteres.

d. Motors backward.

1. Temporales.
2. Masseteres.
3. Digastrici.
4. Mylo-hyoidei.
5. Genio-~~glossi~~. ←
6. Genio-hyo-glossi.

+hyoidei

CHAPTER II.

Of the Muscles of the fore part of the Neck, distributed into Regions, and of some parts similarly situated.

§ I.

Make an incision from the junction of the chin with the side of the lower jaw, down to the middle of the clavicle, dissect the skin back cautiously, and expose the

a. Superficial Cervical Region, which contains two muscles.

1. M. Platysma Myoides. *Musculus cutaneus.*

Situation. Immediately under the skin of the side of the neck; it consists of a thin muscular expansion.

Origin. By a number of thin fleshy slips, from the cellular substance, which covers the upper parts of the deltoid and pectoral muscles. These slips pass obliquely upwards, along the side of the neck.

Insertion. Into the side of the lower jaw, and the skin which covers the lower part of the masseter muscle and parotid gland, and is connected with the depressor anguli oris.

Use. To wrinkle the skin on the side of the neck; it also serves the purpose of a sheath to the muscles situated on the front of the neck.

Under the platysma myoides is found a tough membranous structure, particularly described of late under the name of

Cervical Fascia, *Aponeurosis Cervicalis.* It dips down amongst the muscles, filling up the interstices between them, and seems, indeed, to exist, more or less, in all parts of the body, and to be nothing more than the common reticular membrane, which is locally stronger and thicker, from original conformation, motion or pressure, and for the purposes of support or resistance. It will, probably, be found strongest in those who have become thin after a state of obesity.

2. M. STERNO-CLEIDO MASTOIDEUS.

Situation. Obliquely along the fore part and side of the neck, and forms a projection, which is very distinct in the rotations of the head in the living subject.

Origin. By two distinct attachments: the first, tendinous and fleshy from the upper bone of the sternum, near its junction with the clavicle; the second, fleshy from the fore and upper part of the clavicle. The two heads unite a little above the clavicle to form a strong muscle, which runs obliquely upwards and outwards.

Insertion. Tendinous into the mastoid process, which it surrounds, and becoming thinner into the temporal bone as far back as its junction with the os occipitis.

Use. To turn the head on one side and bend it forwards.

The attention should now be directed to the *submaxillary gland,* of which the situation, extent, and connections, are to be examined.

SUBMAXILLARY GLAND. Is smaller than the parotid gland, and of an oblong figure. Its structure is the same as that of the parotid, and its excretory duct formed in the same way; but its parietes are extremely thin. It is situated on the inside of the horizontal ramus of the inferior maxillary bone, between the bellies of the digastricus; and is continued as far back as the angle of the bone, between the mylo-hyoideus and pterygoideus internus. It rests partly upon the mylo-hyoideus, but a portion of it extends beyond the posterior edge of that muscle, and is in contact with the hyo-glossus, upon which it sends a slip which runs between the mylo-hyoideus and hyo-glossus as far as the anterior edge of the latter muscle. The duct proceeds from the deepest part of the gland near the hyo-glossus, inwards and forwards between the mylo-hyoideus and hyo-glossus, below and to the inner edge of the sublingual gland, and having reached the anterior edge of the hyo-glossus it mounts perpendicularly upwards and terminates by the side of the frænum of the tongue, by a small and somewhat prominent orifice.

The course of the duct cannot be seen till the mylo-hyoideus has been removed.

The muscles which are attached to the os hyoides are next to be dissected. They are distributed into two regions, the *superior* and *inferior hyoideal.* But before we proceed with the dissection it is necessary to have a general knowledge of several parts with which they are connected.

OS HYOIDES. Is situated at the upper part of the neck, and may be felt beneath the integuments. It gives

the points of attachment to the base of the tongue and to the principal muscles connected with that organ. It is of a horse-shoe shape, and is divided into a *base* or broad part, placed in front, and into two *cornua*, which extend backwards on each side. Two other smaller processes, called *appendices*, are placed at the upper part of the bone where the cornua are joined with the base.

LARYNX. Is situated beneath the os hyoides. It is composed of five elastic cartilages, connected by ligament and membrane, viz.

THYROID CARTILAGE. The largest of these, which forms the upper and fore part. It is formed of two lateral portions, or *alæ*, united in front, where they form a projection in the male, distinct in the living subject, called the *pomum Adami*. From the upper and posterior angle of each ala a process extends upwards, called the *superior cornu*. From the lower and posterior angle a similar, but shorter process reaches downwards, named the *inferior cornu*.

CRICOID, or ANNULAR CARTILAGE. Is placed below the thyroid. It forms the under and back part of the larynx. It is narrow in front, immediately below the thyroid, but increases in breadth at the sides and back part.

ARYTÆNOID CARTILAGES, two in number, of small size, and of a pyramidal shape; they are situated at the upper and back of the cricoid cartilage.

EPIGLOTTIS is of a leaf-like shape, is placed just below the root of the tongue, and covers the upper opening into the larynx.

TRACHÆA, or Air-Tube. Is continued from the cricoid cartilage down the fore part of the neck into the chest. It is rounded in front and flattened behind, and is composed principally of cartilage and membrane.

THYROID GLAND. Is situated at the under and lateral part of the larynx, and extends upon the trachæa. It is formed of two considerable lobes, of a reddish colour, connected by an intermediate portion, which lies across the fore and upper part of the trachæa.

Behind the nose and mouth is the

PHARYNX, a membranous bag, which contracts below, and terminates opposite to the cricoid cartilage in the œsophagus.

ŒSOPHAGUS. This is a cylindrical muscular tube, through which the food descends into the stomach. It passes down behind the trachæa into the chest, and is inclined in its course rather to the left. It rests behind upon the cervical vertebræ, and is connected before with the trachæa.

As a more particular description of these parts will be given hereafter, the dissection may now be continued.

b. SUPERIOR HYOIDEAL REGION, containing four muscles.

1. M. DIGASTRICUS.

Situation. Below the jaw; its origin partially covered by the insertion of the sterno mastoideus, its insertion directly under the chin.

Origin. Tendinous and fleshy from the digastric fossa, at the root of the mastoid process of the temporal bone. It passes downward and forward, and forms a strong round tendon, which passes through the stylo-hyoideus, and is fixed by ligament to the os hyoides. It runs then obliquely upwards and forwards, and forms a second fleshy belly.

Insertion. Into the rough surface at the under part of the symphysis of the lower jaw.

Use. To pull the lower jaw down, if the os hyoides be fixed; but if the jaw be fixed, it raises the os hyoides, and with it the larynx.

2. M. STYLO-HYOIDEUS.

Situation. Before the posterior belly or origin of the digastricus, and behind the angle of the lower jaw.

Origin. From the under half of the styloid process. It runs downward and forward.

Insertion. Into the os hyoides at the junction of the base and cornu.

Use. To pull the os hyoides upwards and aside.

3. M. MYLO-HYOIDEUS.

Situation. Partially covered by the submaxillary gland behind, and by the anterior belly of the digastricus before; both of which must be removed, to show its

Origin. Broad and fleshy from the inside of the lower jaw, between the last dens molaris, and the middle of the chin.

Insertion. Into the upper edge of the base of the os hyoides, and joins with its fellow between that bone and the lower jaw.

Use. To depress the lower jaw if the os hyoides be fixed; or to raise the os hyoides if the jaw be fixed.

Turn back the mylo-hyoideus from its attachment to the lower jaw, dissect the *sublingual gland*, and trace the duct of the submaxillary gland into the mouth.

SUBLINGUAL GLAND. Is the smallest of the sali-

vary glands. It is placed as its name implies, lying horizontally upon the inferior surface of the tongue. It is parallel to its fellow, and separated from it by the genio-glossi. On the outer side it corresponds to the membrane of the mouth, above to the tongue, and below to the mylo-hyoideus. Its structure is the same as that of the other salivary glands; but that its excretory apparatus generally consists of a number of small ducts, which, after a short passage, open by the sides of the frænum of the tongue. Sometimes there is one duct considerably larger than the rest, and its coats thin and transparent.

4. M. GENIO-HYOIDEUS.

Situation. Under the anterior edge of the mylo-hyoideus, where it joins with its fellow: divide this junction perpendicularly, and see the

Origin. Tendinous, from a rough protuberance on the inside of the lower jaw, close to the symphysis.

Insertion. Into the base of the os hyoides.

Use. To pull the lower jaw down, or to raise the os hyoides, as the last muscle.

c. INFERIOR HYOIDEAL REGION, containing five muscles, which are principally between the os hyoides and trunk.

1. M. OMO-HYOIDEUS.

Situation. On the side of the larynx and crossing behind the sterno-mastoideus to the scapula.

Origin. Thin and fleshy from the superior costa of the scapula, near the notch, and from the ligament which runs across it. It passes obliquely upwards and forwards, becomes tendinous behind the sterno-mastoid muscle, and again grows fleshy.

Insertion. Into the base of the os hyoides, at the side of the sterno-hyoideus.

Use. To depress the os hyoides and bring it to one side.

2. M. STERNO-HYOIDEUS.

Situation. In front of the larynx and trachæa.

Origin. Thin and fleshy from the upper bone of the sternum internally, from the cartilaginous extremity of the clavicle, and from the clavicle, near the sterno-clavicular articulation.

Insertion. Into the base of the os hyoides.

Use. To pull the os hyoides down.

3. M. STERNO-THYROIDEUS.

Situation. On the side of the trachæa, and partially covered by the last muscle, which must be removed.

Origin. Fleshy from the uppermost bone of the sternum, and from the adjacent part of the cartilage of the first rib.

Insertion. Into the rough oblique line on the ala of the thyroid cartilage externally.

Use. To pull down the thyroid cartilage.

4. M. THYREO-HYOIDEUS.

Situation. On the side of the thyroid cartilage, and covered by the sterno-hyoideus.

Origin. From the rough line opposite to the former.

Insertion. Into part of the base, and almost all the cornu of the os hyoides.

Use. To pull down the os hyoides, or elevate the thyroid cartilage, according as one or other of those parts is fixed.

5. M. CRICO-THYROIDEUS.

Situation. Immediately below the last muscle.

Origin. From the side and fore part of the cricoid cartilage, and runs obliquely upwards and backwards.

Insertion. Into the under part, and into the inferior cornu of the thyroid cartilage.

Use. To pull forward the thyroid or elevate the cricoid cartilage.

The next muscles which are to be dissected, are those of the *lingual region*, or those which are concerned in the motions of the tongue. Previously to examining them it will be advisable to saw through the lower jaw, between the incisor and cuspidatus teeth, and to turn the detached portion of the lower jaw outwards. By those means a clearer view is gained of the muscles by the side of the tongue; and the pterygoidei muscles will be more completely displayed. It will be proper likewise to have a general knowledge of the anatomical division of the tongue before prosecuting the dissection.

TONGUE. This is situated between the branches of the lower jaw. Its upper surface is unconnected, while the lower part, except anteriorly, is attached, by means of membrane and muscles, to the lower jaw and os hyoides. It is divided into *base*, *body*, and *apex*. The *base* is the part attached to the os hyoides. The *apex* is the movable and unconnected point, which is protruded between the teeth. The *body* is the middle portion, the upper surface of which is called *the dorsum*, and is seen when the mouth is opened, and of which the lateral parts are called the *sides*.

d. LINGUAL REGION, containing four muscles belonging to the tongue.

1. M. HYO-GLOSSUS.

Situation. Above the cornu of the os hyoides, and partially covered by the submaxillary gland and its duct.

Origin. Broad and fleshy from the base, cornu, and appendix of the os hyoides, and passes upward and forward.

Insertion. Into the side of the tongue near the stylo-glossus.

Use. To pull the middle of the tongue downwards, and render the dorsum concave.

2. M. GENIO-HYO-GLOSSUS.

Situation. Anterior to the former muscle, and partially covered by it and the sublingual gland.

Origin. Tendinous, from a rough protuberance, close to the symphysis of the lower jaw internally; it spreads, like a fan, under the tongue.

Insertion. Into the whole length of the under and lateral part of the tongue, and into the base of the os hyoides.

Use. The posterior fibres protrude the tongue from the mouth, and the anterior bring it back again; when the anterior and posterior fibres act together, they render the tongue convex from before to behind; the middle fibres pull the dorsum down, and render it concave.

3. M. LINGUALIS.

Situation. Between the hyo-glossus and genio-hyo-glossus, extending along the whole length of the tongue.

Origin. From the root of the tongue laterally. It runs forwards between the hyo-glossus and genio-glossus.

Insertion. Into the apex of the tongue with the stylo-glossus.

Use. To shorten the sides of the tongue, and render it convex laterally.

4. M. STYLO-GLOSSUS.

Situation. Between the styloid process and the root of the tongue.

Origin. Tendinous and fleshy from the styloid process, above the stylo-hyoideus, and from the ligament which is extended between that process and the angle of the lower jaw.

Insertion. Into the base of the tongue laterally, runs along its side, and is continued as far as the apex.

Use. To draw the tongue back, and to assist in rendering the dorsum concave.

The next muscles, in the order of dissection, are those situated about the passage of the fauces, or in the *guttural region,* before the examination of which it will be necessary to consider the principal parts with which they are connected.

PARTS AT THE PASSAGE OF THE FAUCES.

When the mouth is opened, a membranous expansion is seen at its back part, called the *velum pendulum palati,* which extends from right to left, in the form of an arch. From its middle the *uvulà,* or pap of the throat, depends towards the root of the tongue. On each side from the root of the uvula and velum two *arches* or *columns,* distinguished by the names of anterior and posterior, are sent down, which diverge and terminate, the first at the root of the tongue, and the second on the side of the pharynx. Between the anterior and posterior arches on each side, are situated the *tonsils,* or amygdalæ. The passage between the arches is called the *isthmus faucium.*

a. GUTTURAL REGION, containing the five muscles situated about the passage of the fauces, of which four pairs and the single one form the velum palati, one pair forms the anterior, and another the posterior pillar of the arch of the fauces.

1. M. CIRCUMFLEXUS PALATI. *Tensor palati.*

Situation. Deep seated between the petrous portion of the temporal bone and the back of the palate. Saw through the jaw-bone, and remove it in order to see this and the next muscle more distinctly.

Origin. From the spinous process of the sphenoid bone, and from the bony and cartilaginous part of the Eustachian tube. It runs down along the pterygoideus internus, forms a slender round tendon, which passes over the hook of the internal plate of the pterygoid process, and then spreads within the velum.

Insertion. Into the velum pendulum palati, and into the semilunar edge of the os palati, extending as far as the palatine suture.

Use. To stretch the velum and draw it downwards.

2. M. LEVATOR PALATI.

Situation. Behind the last muscle, and of larger size.

Origin. Tendinous and fleshy from the point of the petrous portion of the temporal bone, and from the membranous portion of the Eustachian tube.

Insertion. Into the velum pendulum palati as far as the root of the uvula, where it joins with its fellow.

Use. To draw the velum upwards, so as to shut up the posterior openings of the nostrils.

3. M. CONSTRICTOR ISTHMI FAUCIUM.

Situation. In the anterior pillar of the fauces; it is to be dissected in the mouth.

Origin. From the side of the tongue near its base. It runs upwards within the doubling of membrane, which forms the anterior arch of the fauces.

Insertion. Into the middle of the velum palati at the root of the uvula, where it is connected with its fellow.

Use. To narrow the passage of the fauces.

4. M. PALATO-PHARYNGEUS.

Situation. In the posterior pillar of the fauces, and spreading upon the inside of the pharynx, where it must be dissected.

Origin. From the middle of the velum palati, at the root of the uvula, and from the tendinous expansion of the circumflexus palati. The fibres are collected within the posterior arch, and then spread in the upper and lateral part of the pharynx, mixing with those of the stylo-pharyngeus.

Insertion. Into the edge of the upper and back part of the thyroid cartilage; some of its fibres being lost between the membrane and two inferior constrictors of the pharynx.

Use. To pull down the velum, or to assist in raising the pharynx, and bringing it forwards; it also expands the opening of the Eustachian tube.

5. M. AZYGOS UVULÆ.

Situation. In the uvula, it is a single muscle, and to be dissected in the mouth.

Origin. From the palate bones, where they are joined by suture. It runs through the middle of the velum palati, and through the whole length of the uvula.

Insertion. Into the tip of the uvula.

Use. To raise the uvula and bring it forwards.

e. PHARYNGEAL REGION, containing four muscles, which, with the palato pharyngei, form the pharynx.

1. M. STYLO-PHARYNGEUS.

Situation. Above the stylo-glossus.

Origin. Fleshy from the root of the styloid process.

Insertion. Into the side of the pharynx, and into the back part of the thyroid cartilage.

Use. To dilate the pharynx and pull it upwards; at the same time it raises the thyroid cartilage.

The other muscles of the pharynx, consisting of the three constrictors, may be dissected by cutting through the trachæa and œsophagus, and then drawing them upwards and forwards, so as to bring into view the back part of the pharynx, the cavity of which should be previously stuffed.

2. M. CONSTRICTOR PHARYNGIS INFERIOR.

Situation. Just above the termination of the pharynx in the œsophagus.

Origin. From the sides of the thyroid and cricoid cartilages. The superior fibres run obliquely upwards, covering the under part of the next muscle; the inferior fibres run more transversely.

Insertion. By joining with its fellow at a white line, which is continued along the middle at the back part of the pharynx.

Use. To compress that part of the pharynx which it covers, and to raise it a little upwards.

3. M. CONSTRICTOR PHARYNGIS MEDIUS.

Situation. Above the last muscle.

Origin. From the appendix and cornu of the os hyoides, and from the ligament which connects the cornu to the thyroid cartilage. The fibres run obliquely upwards, cover a considerable part of the superior constrictor, and terminate in a point.

Insertion. Into the cuneiform process of the os occipitis, and is connected with its fellow at a white line on the middle of the back part of the pharynx.

Use. To compress the pharynx, and to draw it and the os hyoides upwards.

4. M. CONSTRICTOR PHARYNGIS SUPERIOR.

Situation. Between the last pair of muscles.

Origin. From the cuneiform process of the os occipitis, from the pterygoid process of the sphenoid bone, and from both jaws near the last dentes molares. Between the jaws it intermixes with the buccinator muscle, and is connected with the root of the tongue and palate.

Insertion. By joining with its fellow at a white line in the middle of the back part of the pharynx.

Use. To raise the pharynx.

Notwithstanding the dissection of this region has been given here, it is much the best plan to leave it till the muscles of the neck have been dissected; the head can then be separated from the first cervical vertebra, and the form of the pharynx, with the attachment of its muscles, can be better seen.

CHAPTER III.

Of the Thorax.

§ 1. OF PARTS EXTERIOR.

Of the muscles belonging to this division, a part have been already presented in the course of dissection adopted, (see p. 71;) and others will be described in the place most convenient for their examination. We commence then with the Mamma.

Mamma. Is a gland peculiar to the female, of a rounded form, situated on the anterior, and a little towards the lateral part of the thorax; it adheres loosely, by cellular substance, to the surface of the large pectoral muscle, in part to the serratus magnus, extends as far as the axilla. It is of a flattened oval figure, and of a whitish colour. It is formed of numerous small lobes, united by a dense cellular texture, but the lobes are often not so much agglomerated towards the circumference: and these lobuli are again composed of smaller glandular masses. Its excretory ducts, called the lactiferous tubes, arise by minute radicles from all these glandular masses: they gradually unite into larger canals or trunks, run in a radiated manner towards the root of the nipple, and lastly form from twelve to eighteen larger tubes terminating at the nipple, or *papilla*. This is situated near the centre of the mamma. It is of a cylindrical form, of a redder colour than the rest of the skin of the breast; and composed of the elastic tough cellular substance, which encloses the lactiferous tubes. These are at a little distance from each other, and are coiled up; but when the nipple is drawn out and extended, the ducts become straight and parallel to each other. There is no communication between the lactiferous tubes, and sometimes one or more of them terminate upon the surface of the areola. Upon the apex of the nipple the orifices of the lactiferous ducts appear, and are of the same number with those which enter the base.

Around the nipple there is a circle, or disk, called *areola*,

of a different colour from the rest of the skin of the breast. It varies in colour at different times of life, and during pregnancy is of a darker colour than at other times, in consequence of a change which takes place in the rete mucosum. In the skin of the areola there are numerous sebaceous glands, or follicles.

§ 2. OF THE CONTENTS OF THE THORAX.

The thorax or chest is the superior portion of the trunk; it is of a conical figure, the broadest part expanded over the upper part of the abdominal viscera. Its parietes are formed by the dorsal vertebræ, the ribs, and the sternum, assisted by the clavicle. These bones are bound together by strong ligaments. Their interstices are filled up by the M. intercostales, sterno-costales, levatores & depressores costarum. There are likewise placed upon the chest strong muscles belonging to the vertebral column, the upper extremity, and abdomen. The contents of the thorax are the heart and pericardium, the two lungs and their investing membranes, the pleuræ, and the contents of the mediastinum.

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Having removed the muscles in the anterior and lateral thoracic regions, and taken the upper extremity off, the dissection is to be commenced by removing five or six of the upper ribs, in order to display

The Pleura. The mode in which this is to be managed is as follows: cut through the muscles in the intercostal spaces cautiously, and having so done, a thin semi-transparent membrane will be seen, which is the pleura; insinuate the handle of a knife between it and the rib, and separate them from the sternum to the angle of the rib, which should be sawn through at that part, and at its junction with the sternum.

The Pleura is a thin semi-transparent membrane lining the parietes internally. Externally, where it is attached to the parts which it covers, it is cellular; internally, it is smooth, and lubricated by a small quantity of serous fluid, which exists in the form of vapour in the living state. It is called a *reflected* membrane. The term *reflected*, which is likewise applied in a similar sense to other membranes having a similar disposition, is here equivalent to *turned back*. Thus it gives a close covering to the lung, and is then turned back to give it a second covering, which adheres to the parietes; the investing portion and the reflected portion being continuous, and their internal surfaces in contact throughout, but smooth and without attachments, so as to form a circumscribed cavity without outlet, containing only the proper secretion of the membrane. The term *cavity*, here and in other instances, is not meant to imply actual interspace or vacuity. It denies the adhesion and connection, *not* the contact, of the surfaces by which it is formed. If, therefore, the pleura were separated from the parts with which it is exteriorly connected, it would be seen that the lung, though invested by it as an envelope, is not contained *within* it as in a bag.

On opening the bags of the pleura, by a perpendicular incision, the lungs are seen loosely placed, connected only by their roots.

In examining the extent of the pleura, it must be traced over the parts which it covers: this is called tracing The *Reflection of the Pleura*. The description may be begun at the lateral parts of the sternum; the pleura passes thence outwards upon the parietes of the chest, which it covers throughout, in connection with the ribs and intercostal muscles, as far as the vertebral column; inferiorly, it covers the convex surface of the diaphragm, superiorly, it terminates a little above the first rib in a blind extremity. It passes forwards from the vertebral column, approaches the opposite pleura, leaving a space before the spine, and is continued on to a small portion of the pericardium. Leaving this it passes over the posterior part of the pulmonary vessels on to the surface of the lung, extending over its summit, and its base, exactly adapting itself to the irregularities of its surface, and giving a distinct covering to each lobe. The pleura passes then from the lung over the anterior part of the pulmonary vessels, is continued upon the pericardium, which it covers, approaches the opposite pleura, and terminates at the posterior part of the sternum, where the tracing commenced.

The portion of the pleura which lines the ribs and intercostal muscles is called the *pleura costalis*, and that part covering the lung is termed the *pleura pulmonalis*. These two portions are constantly in contact, whether in exspiration or inspiration, so exactly are the lungs adapted to the parietes of the chest; but after the bag of the pleura is opened, the lung collapsing leaves a considerable space between it and the parietes.

The cavity of the thorax may now be more completely laid open by dividing the cartilages of the ribs close to their union with the bones, and then raising gradually the sternum, with the cartilages attached to it, from below upwards. It will be then seen, that in the middle of the chest, the two *pleuræ* are contiguous to each other, and divide the chest into two unequal cavities, of which the left is the smaller. The separation passes between the sternum and the spine, and is called the *mediastinum*.

MEDIASTINUM. The mediastinum is divided into the *anterior* and *posterior* mediastinum.

a. ANTERIOR MEDIASTINUM. Is formed by the pleuræ from the cartilages of the ribs, and from the pericar-

dium approximating behind the sternum. Nearly opposite to the fourth rib it is inclined to the left margin of the sternum, and terminates about the sixth rib. The direction of the mediastinum, however, varies a little in different subjects. A small quantity of cellular membrane is interposed between the layers of the pleuræ, and at an early period of life in its upper part the remains of the thymus gland are frequently found.

THYMUS GLAND. The thymus gland, placed in the anterior mediastinum, after birth begins to be absorbed, and in age few traces of it are to be found. In the fœtal state it is of considerable size, of a pale red colour, and is composed of two lobes. It has two cornua above and two below; the two inferior are rounded and thicker, and not unfrequently descend as low as the diaphragm; the two superior are more pointed and slender, and ascend in the neck as high as the thyroid gland. The two lobes are made up of numerous lobuli, connected by cellular membrane, and when they are cut into, a milky fluid may be squeezed from them.

If, after having noticed the anterior mediastinum, the sternum be completely removed, a large vein will be seen crossing obliquely from the left to the right side, ✗ where it joins with another which passes down perpendicularly; those are the two subclavian veins, which joining form the vena cava superior. A little below and behind the left subclavian vein will be seen the arch of the aorta with two of its great vessels, that on the right the arteria innominata, and that on the left the arteria carotis communis sinistra; these together form a kind of fork-like space, in which the lower end of the trachæa is seen crossed by the arteria innominata, and having the left carotid on its left edge. As these parts are only connected by loose cellular membrane there is little difficulty in showing them distinctly.

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b. POSTERIOR MEDIASTINUM. Is formed by the two portions of the pleuræ, which pass between the posterior part of the pericardium and the dorsal vertebræ. It is most conveniently dissected by turning the left lung over to the right side, fixing it in that situation, and cutting through the pleura on the left side. Its contents may then be examined. It contains the *aorta*, the main trunk of the arterial system, which is placed rather to the left side upon the vertebræ; the *œsophagus*, the muscular tube which conveys the food from the pharynx to the stomach, which is situated before the aorta below, and inclined to the right; the *vena azygos*, a vein which returns the blood from the intercostal spaces, which takes its course close to the spine upon its anterior part, and the *thoracic duct*, the main trunk of the absorbent vessels. ✗ The thoracic duct passes from the abdomen between the right crus of the diaphragm and the aorta, it is continued up the posterior mediastinum between the aorta on the left, and the vena azygos on the right side; it afterwards passes behind the arch of the aorta, and is continued behind and to the inner side of the left subclavian artery till it leaves the thorax. We may now examine the

Pericardium. It is the investing membrane of the heart, and like the pleura is a reflected membrane. It is situated in the middle of the chest, between the two pleuræ, which it separates, and is connected with the tendon of the diaphragm. It is wider below than at the part above, where it is continued upon the vessels of the heart. Externally, where it is attached to the surrounding parts, it appears cellular. On cutting open the pericardium, its internal surface is found smooth and polished, and lubricated by a serous fluid, called the *liquor pericardii.*

At this point of the dissection, it may be well to notice the

Situation of the Heart. It is placed between the lungs, behind the sternum, resting upon the diaphragm, with its base backwards towards the spine; its apex is somewhat lower, inclined to the left side, and corresponds to the interval between the cartilages of the fifth and sixth ribs. The pericardium gives a close covering to the heart, so as to show the exact figure of this viscus, and is continued on to the great vessels, which are connected with its base. From these it passes off so as to give a second covering to the heart, which is connected with the pleura, and forms like the pleura a circumscribed cavity.

Examine the vessels arising from the heart, viz. anteriorly, the *pulmonary artery*, behind which, and in some measure concealed by it, is the *aorta:* turn the heart to the left, and the *vena cava superior* and *inferior* will be seen, placed behind, and to the right: lift the heart from its situation, and the one or two right, and the two left *pulmonary* veins, especially the two latter, may be seen passing from the lung on each side. These are often called the eight PRIMITIVE VESSELS.

OF THE LUNGS.

The lungs (two in number) occupy the lateral parts of the thorax, and are moulded to the form of the cavities which they fill. Being thus exactly adapted to the parietes of the thorax, their figure cannot be regular, they may be laxly described as conical, and have been sometimes compared in figure to the foot of the ox. Externally toward the ribs they are convex. Internally they are flattened with an anterior depression for the reception of the heart: the pulmonary vessels enter them about the middle of their length. The anterior margin is sharp and thin; and in that of the left

lung there is a hollow which receives the apex of the heart. The posterior and thicker margin is rounded, and received within the angles of the ribs. The base of the lungs is plane, and rests upon the diaphragm, to the form of which it corresponds, the surface facing downwards and forwards. The base is bounded by a thin, slightly indented edge. The summit, *apex*, is narrow, obtuse, and irregular, and is received into the cul de sac formed by the pleura, just above the level of the first rib.

Each lung is divided into *lobes;* the right lung into three lobes, and the left into two. In observing the lungs from the side, a fissure will be seen to extend from a little below the apex obliquely forwards and downwards to the base. The fissure extends through the substance, and divides the lung into two lobes: the superior lobe is broad above, and terminates in a point below; whilst the inferior is pointed above, and occupies below nearly the whole of the base. The right lung is subdivided into three lobes, by a fissure which extends upon the superior lobe obliquely from above to below, and from within to without, varies in length and depth, and sometimes is wanting. Occasionally the left lung likewise has three lobes.

The volume of the lungs varies, according as they are in a state of dilatation or collapse; and in both states it depends on the quantity of air contained: for after respiration has been once performed, it is found that all the air cannot be again expelled. The same cause renders them specifically lighter than water.

The colour of the lungs is pale, or of a greyish white or yellowish brown, with small dark spots; but more commonly they are found of a red, livid brown, or violet colour, or of these colours variously intermixed. These are accidental varieties, depending on the blood which may remain in the capillary vessels. In children they are more pink; but in age become livid, and interspersed with black spots.

The lungs are connected on their internal surface by the pleura, the *reflection* of which begins at this part; by the air-tube; and by the pulmonary vessels consisting of the artery which divides, and of the veins, two of which belong to each lung. The part where these are connected with the lung is called its *root.*

STRUCTURE OF THE LUNG. Is soft and lax, readily receiving and for some time retaining the impression of the finger. Some firmness is given to its texture by the pleura, which closely covers it, as its proper coat. Each lung is composed, 1. of the branches of a membranous and cartilaginous tube for the transmission of air, called trachæa and bronchia; 2. of two sets of blood-vessels, the one consisting of the ramifications of the pulmonary artery, the other of those of the pulmonary veins; and 3. of a reticular texture, which is always found devoid of fat.

The reticular membrane, having been previously destroyed by maceration, the lung is divisible (at least in the fœtus) into a number of lobules of various sizes and form, with angular surfaces, which contain cells, freely communicating with each other, called the *air cells.* Their communication is rendered evident from their ready inflation by the bronchia.

Dissect the course and termination of the

TRACHÆA. Begins below the cricoid cartilage, extends through the middle of the neck to the upper and posterior part of the chest, and terminates about the second or third dorsal vertebra, by dividing into the right and left bronchus. Behind it is placed the œsophagus: before it are the sterno-hyoidei and sterno-thyroidei muscles. To the sides are the carotid arteries, jugular veins, &c.: above, it is surrounded by the thyroid gland. The trachæa is convex before and flattened behind.

The BRONCHI separate from each other and pass to each lung, which they penetrate about the middle of the inner side. The left bronchus is somewhat less capacious than the right, but is longer, from the situation of the heart. Within the substance of the lungs they divide and subdivide into branches, called *bronchia*, which take different directions, are distributed to all parts of the lungs, and become at last so minute that they cannot be traced.

Remove the lungs and heart in one mass, and dissect the trachæa and its bronchi, the great vessels of the heart, and the bronchial glands, for the more convenient examination of their structure.

The *trachæa* is formed of *cartilages* of a horse-shoe form, being about two-thirds of a ring. They vary in number, but are generally about eighteen; are very elastic; broad, convex, and strong, anteriorly; but thinner, posteriorly. They vary likewise in size and form; and it is not unfrequent for two or more to run into one. The first cartilage is generally the largest, and is often united with the cricoid, or next cartilage below it. In the ramifications of the bronchia, the cartilages are at first annular; they soon, however, become imperfect, of an irregular figure, and at length are lost.

An elastic *ligamentous* substance connects the rings of the trachæa, and occupies the space between the ends of the cartilages. This is continued into the bronchia, and seems to be the principal constituent of the air-tube, where the cartilages become defective, but grows thin and indistinct in the minute branches.

The extremities of the rings are also connected by transverse bundles of *muscular fibres*, situated beneath the ligamentous tunic; and there appear likewise to be some muscular fibres, which near their extremities pass obliquely from one ring to the other.

The internal surface of the air-tube is lined by a *mucous membrane.* This probably extends into the minutest ramifications of the bronchia. Posteriorly, it is disposed in longitudinal folds, formed by longitudinal bands, which do not disappear when the membrane is separated. This membrane is highly vascular, as is proved by injection, and extremely sensible. It is constantly lubricated by a mucus, poured forth by small round *glands*, of a reddish or yellowish colour; most of which are situated posteriorly, between the muscular and fibrous coat, and in the cellular membrane about the

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trachæa. Upon the mucous membrane, where the excretory ducts terminate, pores are discovered; and similar pores are observed upon the membrane lining the branches of the bronchi.

About the beginning of the bronchi are situated numerous absorbent glands, called the *bronchial glands*. They vary in number, size, situation, and figure. Their colour in the adult is of a deep blue or brown; in age they become black, and in childhood they are reddish or white.

PULMONARY VESSELS. The vascular system of the lungs consists of two orders of vessels: the ramifications of the pulmonary artery and those of the pulmonary veins.

The PULMONARY ARTERY takes its origin from the right ventricle of the heart; and at the left side of the aorta it divides into two principal branches. The right passes behind the aorta and vena cava superior to enter the right lung before the bronchus: it is the longer of the two. The left, the shorter and less capacious, ascends directly to the left lung. They both divide in the lungs like the bronchi, the course of whose ramifications they follow, and are distributed to all parts of the lungs.

The PULMONARY VEINS begin from the extremities of the pulmonary arteries. They take the course of the other vessels, and are collected into trunks, which terminate at last in four principal veins, two of which belong to each lung, and end in the left auricle. The right superior passes to the superior and right part of the auricle; the inferior ascends from the inferior lobe to the inferior and right part of the auricle. The left pass in like manner to the left side of the auricle, generally, however, being somewhat closer together.

According to the experiments of Haller and others, it would appear that these vessels have communication with the air-tubes: since fluids injected into them pass into the ramifications of the bronchia; and, vice versa, injected into the bronchia, pass into these vessels. But as Haller himself observes, we are not authorized to infer the existence of such communication in the living animal.

OF THE HEART.

The heart should now be prepared for dissection, by cutting through the great vessels at some distance from their origin, and dissecting from them the cellular membrane: but leaving the remains of the *canalis arteriosus*, which appears like a ligamentous cord stretched between the pulmonary artery before its division, and the under part of the arch of the aorta.

The heart is of a conical figure, but flattened on one side, where it rests upon the diaphragm, and fixed only at its base, where it is connected by the great vessels. It is divided into *base, body*, and *apex*, with an *anterior* and *posterior surface*, and a *right* and *left margin*. The *right margin* is thin, and is therefore sometimes called the *acute*, and is generally fat. The *left margin* is thick and rounded, and is called sometimes the *obtuse*. The *base* is placed posteriorly and superiorly towards the vertebral column, from which it is separated by the contents of the posterior mediastinum; and to this part the great vessels are connected. The *apex* is placed anteriorly, inferiorly, and to the left: it corresponds to a slight depression in the lung, and to the space between the fifth and sixth ribs, where its pulsation may be felt during the dilatation of the auricles: it is surrounded generally by fat, and is sometimes divided.

The heart is double, or formed of *two sides*, each of which is divided into two cavities, one of these is distinguished by the name of auricle, the other by that of ventricle; so that there are four cavities; viz. *two* AURICLES and *two* VENTRICLES. The sides have been named *right* and *left*, but improperly, as that called right is rather the anterior, and the left rather the posterior.

The heart is the organ for the reception and propulsion of the blood. The auricles are the reservoirs, and are therefore connected with large veins supplying them. The ventricles are the propelling powers, and are therefore connected with the arteries. It is supplied with valves, which prevent the reflux of the blood.

RIGHT AURICLE. Forms a part of the base of the heart. Its figure is irregular; it is broad posteriorly, and to the right; it is narrow anteriorly, and to the left side, where it terminates in a projecting process called the *appendix*.

In order to demonstrate the internal structure of the auricle, it is to be opened by cutting between the junction of the two venæ cavæ to the septum between the auricle and ventricle, and from this another incision is to be extended upwards and to the left, to open the appendix. The parts then seen are: *behind*, and at the *upper part*, the opening of the *vena cava superior*, directed obliquely downwards and forwards, formed by a rounded and projecting edge of muscular fibres: this opening has the same direction as that which forms the communication between the auricle and ventricle. At the

lower part is the opening of the *vena cava inferior,* which is directed obliquely inwards and upwards. At the part which is common to the two cavæ, Lower has described a tubercle; it is found in brutes, but in the human subject it is problematical, or at least extremely indistinct. At the circumference of the vena cava inferior is a projecting fold of the internal membrane, called the VALVE OF EUSTACHIUS, *valvula nobilis Eustachii;* which varies considerably in size, and often has small perforations: it begins inferiorly, is continued transversely upwards and inwards, and terminates on the partition of the auricle. Below the valve of Eustachius, and immediately above the ventricle, is the OPENING OF THE CORONARY VEIN. To prevent the reflux of this blood, this orifice is provided with a valve, which is called from its figure the SEMILUNAR VALVE, *valvula semilunaris. Anteriorly,* and *above,* is the cavity of the APPENDIX, from the sides of which project bundles of fleshy fibres, crossing each other, but covered by the membrane proper to the auricle. *Below,* is the opening which forms the communication between the auricle and ventricle, the AURICULAR, or AURICULO-VENTRICULAR OPENING. *To the inner side* the auricle is formed by the *septum* common to it, and the left auricle. In the septum is a depression called the FOSSA OVALIS, bounded by a semilunar fold of membrane of considerable strength, the inferior extremity of which is continued with the valve of Eustachius. The bottom of the fossa is formed by a similar valve in the left auricle; and if the handle of a scalpel be passed between the valves, the adhesion may be commonly overcome so as to reestablish the opening of the foramen ovale, which in the fœtal state forms a communication between the two auricles.

RIGHT VENTRICLE. Is of larger size than the auricle, and of a pyramidal figure. Its upper part, or base, answers to the opening of communication with the auricle to the right, and that of the pulmonary artery to the left. Its inferior extremity is situated at the apex of the heart, but a little higher than that of the left ventricle.

The right ventricle should be opened by two incisions, one of which is carried along the upper part of the ventricle transversely, and the other by the side of the septum; the incisions meeting below the pulmonary artery. A triangular flap is thus formed, and the internal structure displayed. On its sides are found numerous bundles of fleshy fibres, called the FLESHY BUNDLES, *carneæ columnæ,* which are so disposed as to form an irregular network; they are of various sizes, but the larger are situated generally nearer the basis, and become more slender towards the apex; they project more or less from the sides, some remaining attached only at their extremities. Amongst them are three bundles, occasionally more, which are larger than the rest, and not always arising from the same part, these ascend perpendicularly, and terminate in a rounded extremity; from them arise TENDINOUS CORDS, *chordæ tendineæ*, which diverge, and are attached to a membranous fold, from the margin of the auricular opening, called the TENDINOUS CURTAIN, *cortina tendinea*.

There are two openings from the ventricle, that of communication with the auricle superiorly, and to the right; and that of the pulmonary artery superiorly, and to the left. The AURICULAR OPENING is the larger, and occupies nearly the whole of the base of the ventricle: its boundary is marked by a white line, which has been called the TENDINOUS ZONE, *zona tendinea*, but which appears to be nothing more than condensed cellular membrane. From the margin of this opening is extended a loose membranous fold, called the cortina tendinea, the edge of which has three points, or projections: it is fixed, as has been before observed, by means of the *chordæ tendineæ* to the *carneæ columnæ*, and forms in this manner the TRICUSPID VALVE, *valvula tricuspis*. The OPENING OF THE PULMONARY ARTERY is placed obliquely. Towards it the bundles of fleshy fibres become larger, thicker, and less numerous. At the beginning of the artery are three valves, called the SIGMOID, or SEMILUNAR, *valvulæ semilunares*, two on the fore and one on the back part of the artery. Each of them forms a sack, which is attached by its convex edge to the sides of the artery, whilst the other is loose and projecting. The unattached edge of each valve is somewhat thicker and stronger than the other parts, and has in its middle a small body, or thickening, called *corpusculum sesamoideum Arantii*.

At the part where the pulmonary artery divides, a ligamentous rounded cord of some size arises from it, and passes to the concave part of the curvature of the aorta, to the side of which it is attached. It is the remains of the *canalis arteriosus*, a vessel which, in the fœtus, forms a communication between the pulmonary artery and the aorta.

LEFT AURICLE. It receives from each side the pulmonary veins, and it terminates to the left, and somewhat anteriorly, in a projecting appendix, which is all that can be seen of the left auricle in the natural situation of the heart. If the heart be raised and turned to the right, the posterior surface will be seen, which is covered by the pericardium. The form of the whole is irregular, and its extent cannot be

ascertained without introducing the finger into its cavity. In order to examine the internal structure of the auricle, it is to be opened without injuring the pulmonary veins, which may be accomplished by a crucial incision between them. The *inner side* is formed by the septum of the auricles, on the surface of which is a kind of semilunar valve, the convex edge of which passes continuously into the surface of the auricle behind. This fold of membrane is applied to the corresponding valve of the right auricle; but is so situated with respect to it, that if they were separated from each other, the passage between the auricles would be oblique. The concave edge of the valve bounds a space like that of the fossa ovalis of the right side, but less deep. *To the right* the PULMONARY VEINS of that side enter, the one from above to the upper part, the other from below obliquely to the lower part, and *to the left* are seen the openings of the TWO LEFT PULMONARY VEINS. The latter are close to each other, and sometimes form but a single opening. Before them is the cavity of the *appendix:* its surface is unequal from bundles of muscular fibres, but which are not so numerous as those in the appendix of the right auricle. *Below,* and *anteriorly,* the auricle is terminated by a large opening, by which it communicates with the left ventricle, namely, by the AURICULO-VENTRICULAR OPENING.

LEFT VENTRICLE. Its form is conical, somewhat like the less end of an egg. In consequence of the thickness of its parietes, it does not become flattened when empty, like the right, but appears rounded transversely. It is longer than the right ventricle, its apex projecting more.

Its internal structure is best displayed by two incisions, one carried along the septum, the other along the upper part of the ventricle transversely, so as to meet the first below the opening of the aorta. They thus form an L reversed (⅂).

The internal surface presents a network of bundles of muscular fibres, not so numerous, however, nor so irregularly disposed, as those in the right ventricle. Two columns, *carneæ columnæ,* considerably larger than the others, arise from the middle of the parietes, the one from the anterior, the other from the posterior surface. These pass from below upwards, obliquely in the cavity, towards the base. The column is not always single, but often consists of two or more shafts, terminating in a rounded extremity; from which arise minute TENDINOUS CORDS, *chordæ tendineæ,* that diverge and become attached to the edge of the membranous fold, which extends from the margin of the auricular opening. The left ventricle terminates superiorly by two openings, the auricular and the opening of the aorta. The AURICULAR OPENING is the larger, and corresponds with the size of the auricle. From its circumference is continued the TENDINOUS CURTAIN, *cortina tendinea*, which has commonly two projections, the one opposite to the obtuse edge, and the other opposite to the aortic opening. To this curtain the *chordæ tendineæ* before spoken of are attached, and thus is formed the BICUSPID OR MITRAL VALVE, *valvula mitralis*, of the auricular opening. The OPENING OF THE AORTA is situated a little more anteriorly: it has *three semilunar valves*, which resemble those of the pulmonary artery, but are thicker and stronger. Opposite to them are three depressions or enlargements of the aorta, called the SINUSES, *sin. Valsalvæ:* in the two anterior sinuses, a little above the edge of the valves, are the openings of the two coronary arteries.

STRUCTURE OF THE HEART. The proper structure of the heart is muscular, its external surface covered by the close portion of the pericardium; and it has a peculiar *lining* of membrane. The muscular fibres composing it cross each other in all directions, but on the exterior assume a more regular disposition. The thickness of the muscular coat varies at different parts: it is thinner in the auricles than in the ventricles; and in the ventricles it is much thinner on the right side than on the left. It is thick where it forms the septum both of the auricles and ventricles. Between the muscular covering and the pericardium, more or less fat is usually deposited, and it is more abundant generally on the right side, and in the course of the coronary vessels. The membrane which lines the heart gives a smooth and polished surface to the interior of its cavities: it is so thin that, in some parts, it appears to be wanting; but even in these it may be detached in small portions.

CORONARY VESSELS. The two *arteries* so called, and by which the heart is supplied, are the first branches given off by the aorta, and arise from that vessel nearly opposite to the edges of the semilunar valves, as has been already described. They are distinguished by the names of *right* and *left coronary*. The *right*, or anterior, takes its course transversely between the right auricle and ventricle, is continued to the flattened surface of the heart, then passes in the direction of the septum as far as the apex of the heart. It distributes branches in its course, which principally supply the right side. The *left*, or posterior artery, passes downwards, covered by the appendix of the left auricle, to the convex surface of the heart; one branch continuing in the groove between the ventricles, as far as the apex, and anastomosing with the right artery; another branch passing in the groove between the left auricle and ventricle, to the flattened surface of the heart. This left artery distributes branches chiefly to the left side of the heart.

The coronary *veins* accompany the arteries. The greater number uniting form a considerable trunk, which passes between the left auricle and ventricle, and terminates as has been already described, at the under part of the right auricle. There is generally a smaller vein, which runs upon the right ventricle, and terminates in the appendix of the auricle. Besides these, the blood is supposed to find its way into the cavities of the heart from the blood vessels by orifices, which are called the *foramina Thebesii*. Their existence has been supposed to be established by the fact, that fluids injected into the coronary vessels are frequently found to make their way into the cavities of the heart.

§ 3. OF THE MUSCLES PARTICULARLY CONNECTED WITH THE RIBS, DISTRIBUTED INTO REGIONS, viz.:

a. Intercostal Region, containing five muscles.

1. M. Intercostales Externi.

Situation. Between the ribs externally.

Origin. From the under edge of each rib, excepting the twelfth; from the spine to the junction of the ribs with their cartilages. From these to the sternum they are discontinued, and their place occupied by an aponeurosis. They pass obliquely downward and forward.

Insertion. Into the upper edge of each rib, immediately below that from which they arise.

Use. To raise the ribs.

2. M. Intercostales Interni.

Their mode of origin and insertion is the same as that of the intercostales externi; but they begin at the sternum, run obliquely downwards and backwards, decussating with the externi, and are continued only as far as the angle of the ribs. They are situated within the thorax.

Use. To raise the ribs.

3. M. Levatores Costarum.

Are portions of the intercostales externi, which arise from the transverse processes of the vertebræ, and terminate in the ribs immediately below.

Use. Implied in the name.

4. M. Depressores Costarum.

Are portions of the intercostales interni, which at the lower part of the chest pass over one rib, and are inserted into the next below it.

Use. Implied in the name.

5. M. Sterno-costalis.

Situation. Within the thorax; the sternum and cartilages of the ribs must be removed together to see this muscle.

Origin. From the edge of the cartilago ensiformis, and from the lower half of the middle bone of the sternum. It passes upwards and outwards.

Insertion. Generally into the cartilage of the third, fourth, and fifth ribs, sometimes also into that of the second and sixth.

Use. To depress the cartilages of those ribs.

b. Lateral Cervical Region, containing three muscles.

1. M. Scalenus Anticus.

Situation. On the side of the neck.

Origin. From the transverse processes of the fourth, fifth, and sixth cervical vertebræ.

Insertion. Tendinous and fleshy into the upper part of the first rib, near its cartilage.

2. M. Scalenus Medius.

Situation. Behind and above the former muscle.

Origin. Tendinous from the transverse processes of all the cervical vertebræ.

Insertion. Into the posterior half, upper and outer part of the first rib.

Between the two above muscles the subclavian artery takes its course, and at that part the scalenus anticus separates the artery from the vein, which runs before that muscle.

3. M. Scalenus Posticus.

Situation. Behind the scalenus medius.

Origin. From the transverse processes of the fifth and sixth cervical vertebræ.

Insertion. Into the upper edge of the second rib, near the spine.

The *Use* of these three muscles is to bend the neck to one side, or to elevate the ribs.

c. Vertebro-costal Region, containing two muscles situated on the back, and covered by those of the dorso cervical and dorso lumbar regions.

1. M. Serratus Superior Posticus.

Situation. On the upper and back part of the chest.

Origin. Tendinous from the spinous processes of the three undermost cervical, and of the two uppermost dorsal, vertebræ.

Insertion. Into the second, third, fourth, and fifth ribs, by as many fleshy slips.

Use. To elevate the ribs into which it is inserted, and with them the parietes of the chest.

2. M. Serratus Inferior Posticus.

Situation. On the loins.

Origin. Thin and tendinous in common with the latissimus dorsi, from the spinous processes of the two undermost dorsal, and of the three uppermost lumbar vertebræ.

Insertion. Into the lower edges of the four lowest ribs, by as many fleshy slips.

Use. To depress those ribs, and with them the parietes of the chest.

Diaphragm. As one of the principal muscles of respiration, the diaphragm may be properly considered under the same class with these muscles, and with some others not here enumerated; but its examination must be postponed till the abdomen have been dissected.

CHAPTER IV.

Of the Muscles nearest to the Vertebral Column.

Most of the muscles in the immediate neighbourhood of the vertebral column are placed on the posterior part of the trunk: but there are also some on the fore part of the neck, which however cannot be seen till the pharynx, œsophagus, and trachæa have been removed; they form the

a. Anterior Deep Cervical, containing four muscles.

1. M. Longus Colli.

Situation. The innermost of the muscles in this region.

Origin. Tendinous and fleshy from the bodies of the three superior vertebræ of the back laterally, and from the transverse processes of the third, fourth, fifth, and sixth vertebræ of the neck.

Insertion. Into the fore part of the bodies of all the vertebræ of the neck, by as many tendinous and fleshy slips.

Use. To bend the neck forwards and to one side; if both act, to bend it directly forwards.

2. Rectus Capitis Internus Major.

Situation. To the outer side of the longus colli.

Origin. From the fore part of the transverse processes of the third, fourth, fifth, and sixth vertebræ of the neck.

Insertion. Into the cuneiform process of the os occipitis.

Use. To bend the head forwards.

3. Rectus Capitis Internus Minor.

Situation. Covered almost entirely by the last muscle.

Origin. From the fore part of the body of the first vertebra of the neck.

Insertion. Into the cuneiform process of the os occipitis, near the root of its condyloid process.

Use. To bend the head forwards upon the first vertebra.

4. RECTUS CAPITIS LATERALIS.

Situation. To the outer side of the last muscle, and covered by the internal jugular vein.

Origin. From the fore part of the transverse process of the first vertebra of the neck.

Insertion. Into the os occipitis, immediately behind the jugular fossa.

Use. To bend the head a little on one side.

The following are situated on the posterior part of the neck and trunk.

b. SUPERFICIAL CERVICO-OCCIPITAL REGION, containing four muscles.

1. M. SPLENIUS.

Situation. On the back, and on the side of the neck: covered in part by the trapezius, rhomboidei, and serratus superior posticus, which must be removed to expose it completely.

Origin. From the spinous processes of the five inferior cervical, and of the four superior dorsal vertebræ, and adheres to the ligamentum nuchæ. At the third vertebra of the neck the splenii recede from each other, so that part of the complexus muscle is seen.

Insertion. Into the transverse processes of the five superior cervical vertebræ, into the posterior part of the mastoid process, and into the adjoining part of the os occipitis. It is sometimes divided into the *splenius capitis*, or that portion which is fixed to the head, and into the *splenius colli*, or that portion which is inserted into the cervical vertebræ.

Use. To bring the cervical vertebræ and head backwards laterally: when both muscles act they bring the head directly backwards.

2. M. COMPLEXUS.

Situation. On the back of the neck, covered in part by the splenius, and extending down the back between the longissimus and spinalis dorsi.

Origin. From the transverse processes of the four inferior cervical, and of the seven superior dorsal vertebræ, receiving an additional fleshy slip from the spinous process of the first vertebra of the back.

Insertion. Into the protuberance, and part of the arched ridge of the os occipitis.

Use. To draw the head backwards and to one side; if both act, they bring the head directly back.

The portion of this muscle which is situated next to the spinous processes, and has a rounded tendinous intersection, has been sometimes named the *M. biventer cervicis.*

3. M. TRACHELO-MASTOIDEUS.

Situation. On the side of the neck, to the outer side of the complexus.

Origin. From the transverse processes of the five undermost cervical, and of the three uppermost dorsal vertebræ.

Insertion. Tendinous into the back part of the mastoid process.

Use. To assist the complexus in pulling the head aside.

4. M. TRANSVERSALIS COLLI.

Situation. On the side of the neck and to the outer edge of the last muscle, with which it is closely connected.

Origin. From the transverse processes of the five uppermost dorsal vertebræ.

Insertion. Into the transverse processes of all the cervical vertebræ, except the first and last.

Use. To turn the head obliquely backwards.

c. DEEP CERVICO-OCCIPITAL REGION, containing four muscles, which are covered by the complexus.

1. M. RECTUS CAPITIS POSTICUS MAJOR.

Situation. Upon the back of the arch of the first vertebra.

Origin. From the spinous process of the second cervical vertebra, and passes obliquely upwards and outwards, growing broader in its ascent.

Insertion. Into the os occipitis.

Use. To pull the head backwards.

2. M. RECTUS CAPITIS POSTICUS MINOR.

Situation. Covered by the former.

Origin. From the protuberance, which answers to a spinous process on the first cervical vertebra.

Insertion. Under the former into the os occipitis near the foramen magnum.

Use. To assist the action of the last muscle.

3. M. OBLIQUUS CAPITIS SUPERIOR.

Situation. Above the rectus major, nearly transversely.

Origin. From the transverse process of the first cervical vertebra.

Insertion. Into the os occipitis, behind the mastoid pro-

cess of the temporal bone, and to the outer side of the insertion of the rectus major.

Use. To draw the head backwards.

4. M. Obliquus Capitis Inferior.

Situation. Below the rectus major and obliquus superior, with which two muscles it forms a triangle.

Origin. From the spinous process of the second cervical vertebra.

Insertion. Into the transverse process of the first vertebra of the neck.

Use. To bring the head with the first vertebra to one side; when both muscles act alternately a rotatory motion is produced.

d. Vertebral Region, containing eight muscles.

1. M. Sacro-Lumbalis.

Situation. Extending along the angles of the ribs down to the sacrum.

Origin. Tendinous without, and fleshy within, from the side, and all the spinous processes of the os sacrum, from the posterior part of the spine of the ilium, and from all the spinous processes, and the roots of the transverse processes of the lumbar vertebræ.

Insertion. Into the angle of each of the ribs by a long and thin tendon.

Use. To keep the body erect and to pull down the ribs.

From the six or eight inferior ribs arise as many fleshy slips, which terminate in the inner side of this muscle, and are named the *Musculi ad sacro-lumbalem accessorii*, they pull the ribs upwards, the muscle itself becoming the fixed point. From the upper part of the muscle a fleshy slip, called *M. cervicalis descendens*, ascends, and is inserted into the transverse processes of the fourth, fifth, and sixth cervical vertebræ: it turns the neck obliquely backwards and aside.

2. M. Longissimus Dorsi.

Situation. On the inner side of the sacro-lumbalis, with which it is closely connected.

Origin. In common with the sacro-lumbalis.

Insertion. Into the transverse processes of all the dorsal vertebræ, chiefly by small double tendons, and by a tendinous and fleshy slip into the lower edge of all the ribs, excepting the two undermost, near the tubercles.

Use. It extends the vertebræ, and keeps the body erect.

From the upper part of this muscle a round fleshy slip ascends and joins with the cervicalis descendens.

3. M. SPINALIS DORSI.

Situation. Close on the side of the spinous processes of the back.

Origin. From the spinous processes of the three undermost dorsal, and of the two uppermost lumbar vertebræ, by as many tendons.

Insertion. Into the spinous processes of the nine uppermost dorsal vertebræ, except the first.

Use. To extend the spine backwards.

4. M. SEMISPINALIS COLLI.

Situation. Under the complexus, between the transverse and spinous processes of the cervical vertebræ.

Origin. From the transverse processes of the six uppermost dorsal vertebræ, by distinct tendons, and runs obliquely under the complexus.

Insertion. Into the spinous processes of all the cervical vertebræ, except the first and last.

Use. To extend the neck obliquely backwards; if both act, to draw it directly back.

5. M. SEMISPINALIS DORSI.

Situation. Between the transverse and spinous processes of the dorsal vertebræ.

Origin. From the transverse processes of the seventh, eighth, ninth, and tenth dorsal vertebræ.

Insertion. Into the spinous processes of the two undermost cervical, and four uppermost dorsal vertebræ, by distinct tendons.

Use. To extend the neck obliquely back.

6. M. MULTIFIDUS SPINÆ.

Situation. Close to the spine.

Origin. From the side and spinous processes of the os sacrum, from the posterior part of the spine of the os ilium, from the articular and transverse processes of all the lumbar vertebræ, and from the transverse processes of all the dorsal, and all the cervical, except the three first, by distinct tendons, which soon become fleshy, and take an oblique direction.

Insertion. By distinct tendons into the spinous processes of all the vertebræ of the loins, of the back, and of the neck, except the first.

Use. To move different portions of the spine laterally.

7. M. Interspinales. Are smaller muscles, which are situated between, and attached to the spinous processes of the contiguous vertebræ. They are only distinctly fleshy in the cervical vertebræ, and are five in number. Each arises double from the spinous process of the lower vertebra, and is inserted into the spinous process of the vertebra above. In the dorsal and lumbar vertebræ they are rather small tendons than muscles.

Use. To assist in extension of the spine.

8. M. Intertransversales. Are similar small fleshy bundles, which pass between the transverse processes of the contiguous vertebræ. Those of the neck consist of six distinct double muscles. There are also four distinct fleshy bundles between the transverse processes of the lumbar vertebræ; but those of the back are rather tendons than muscles.

Use. To sway the vertebræ laterally on each other.

In the above account of the dorsal muscles their attachments are stated according to the description which has been adopted by most anatomists; but it is necessary to remark that they are subject to frequent varieties, and that they are frequently found to be attached to a fewer or greater number of vertebræ, than has been there laid down.

The Relative Situation of the Muscles of the Back, in Layers.

In the *first* layer, *two* pairs,
M. Trapezii.
M. Latissimi dorsi.

In the *second* layer, *four*,
M. Levatores scapularum.
M. Rhomboidei minores.
——————— majores.
M. Serrati inferiores postici.

In the *third* layer, *one*,
M. Serrati superiores postici.

In the *fourth* layer, *four*,
M. Splenii.
M. Spinales dorsi.
M. Longissimi dorsi.
M. Sacro lumbales et accessorii.

In the *fifth* layer, *four*,

M. Complexi.
M. Trachelo mastoidei.
M. Transversales colli.
M. Cervicales descendentes.

In the *sixth* layer, *six*,

M. Semispinales dorsi.
M. Semispinales colli.
M. Recti postici majores.
———— minores.
M. Obliqui superiores.
———— inferiores.

In the *seventh* layer, *four* sets,

M. Multifidi spinæ.
M. Interspinales.
M. Intertransversales.
M. Levatores costarum.

§ 4. TABLE EXHIBITING THE ACTIONS OF THE MUSCLES WHICH PRODUCE THE MOVEMENTS OF THE THORAX, OF THE HEAD, AND OF THE VERTEBRÆ.

1. Motions of the Thorax. They are those which take place during respiration. They consist of the motions in *inspiration*, by which the chest is enlarged in all its dimensions, and by means of which the lungs are filled with air; these are produced by the elevation of the ribs and the descent of the diaphragm: and of the motions of *exspiration*, by which the chest is contracted in all its dimensions, and by means of which the air is again expelled from the lungs; these are produced by the depression of the ribs and the ascent of the diaphragm. The muscles may therefore be arranged, as—*a*. Muscles of Inspiration, and *b*. Muscles of Exspiration. It is to be observed, however, that the diaphragm is the principal agent both of inspiration and exspiration, and in unconstrained breathing is but feebly assisted by the muscles which move the ribs not excepting even the intercostales. When respiration is carried on with some effort, the intercostal muscles are more exerted; but it is only in laborious breathing that the numerous other muscles attached to the ribs are called into action.

a. MUSCLES OF INSPIRATION.

1. Diaphragma.
2. Intercostales.
3. Levatores costarum.
4. Depressores costarum.

Assisted occasionally by the

1. Sterno-mastoidei.
2. Scaleni antici.
3. Scaleni medii.
4. Scaleni postici.
5. Serrati postici superiores.
6. Serrati magni.
7. Subclavii,
8. Pectorales majores,
9. Pectorales minores,
10. Latissimi dorsi, } when the shoulders are fixed.

b. MUSCLES OF EXSPIRATION.

1. Triangularis sterni.
2. Obliqui externi abdominis.
3. Obliqui interni abdominis.
4. Transversi abdominis.
5. Recti abdominis.
6. Pyramidales.

Assisted occasionally by the

7. Serrati postici inferiores.
8. Longissimi dorsi.
9. Sacro-lumbales.
10. Quadrati lumborum.

2. MOTIONS OF THE HEAD AND CERVICAL VERTEBRÆ. There are inflections of the head upon the atlas, but they are very inconsiderable: consisting of *inflections forwards,* which are performed by the, 1. Recti capitis interni minores—2. Recti capitis laterales: of *inflections backward,* which are performed by the, 1. Recti capitis postici minores—2. Obliqui capitis superiores; and of *lateral inflections* by these muscles at the sides. But the principal motions of the head are produced by the inflections of the cervical vertebræ; which may be bent *forwards* or *backwards,* and

to either side, and give a corresponding inclination to the head. Likewise in consequence of the mode of articulation between the first and second vertebræ, the former, together with the head, may perform a motion of *rotation* upon the latter. Therefore the muscles moving the head and cervical vertebræ may be arranged as—*a.* Inflectors forward, *b.* Inflectors backward, *c.* Rotators to the right, *d.* Rotators to the left. It will not be necessary to particularize the muscles which inflect laterally, as all the muscles which are described as inflectors forward and backward, must exert a force in the lateral direction when used only on one side, except those which are situated close to the median plane.

a. Inflectors forward.

1. Musculi cutanei.
2. Digastrici,
3. Mylo-hyoidei,
4. Genio-hyoidei,
5. Genio-hyo-glossi, } when the lower jaw is closed.
6. Omo-hyoidei,
7. Sterno-hyoidei,
8. Sterno-thyroidei,
9. Thyreo-hyoidei } by fixing and drawing down the os hyoides.
10. Sterno-mastoidei.
11. Recti capitis interni majores.
12. Longi colli.
13. Scaleni antici.

b. Inflectors backward.

1. Trapezii.
2. Splenii.
3. Complexi.
4. Trachelo-mastoidei.
5. Cervicales descendentes.
6. Transversales colli.
7. Recti capitis postici majores.
8. Obliqui capitis inferiores.
9. Spinales colli.
10. Semispinales colli.
11. Multifidi spinæ.
12. Scaleni postici.

N. B. The *scaleni medii* appear to act exclusively as lateral inflectors.

c. ROTATORS of the head to THE RIGHT.

1. Right musculus cutaneus.
2. Left sterno-mastoideus.
3. Left trapezius.
4. Right splenius.
5. Left complexus.
6. Right rectus capitis posticus major.
7. Right obliquus capitis inferior.
8. Right trachelo-mastoideus.

d. ROTATORS of the head to THE LEFT.

1. Left musculus cutaneus.
2. Right sterno-mastoideus.
3. Right trapezius.
4. Left splenius.
5. Right complexus.
6. Left rectus capitis posticus major.
7. Left obliquus capitis inferior.
8. Left trachelo-mastoideus.

MOTIONS OF THE DORSAL AND LUMBAR VERTEBRÆ. The motions of these vertebræ affect the whole trunk. They consist of *inflections forward—backward*—and *to either side.* The muscles may be divided into—*a.* INFLECTORS FORWARD, and *b.* INFLECTORS BACKWARD. These, when used only on one side, will exert a force in the lateral direction, and therefore need not be arranged as lateral inflectors.

a. INFLECTORS FORWARD.

1. Pectorales majores,	when the ribs and shoulders are fixed.
2. Pectorales minores,	
3. Serrati magni,	
4. Obliqui externi abdominis,	when the ribs are fixed.
5. Obliqui interni abdominis,	
6. Transversales abdominis,	
7. Recti abdominis,	
8. Pyramidales,	
9. Psoæ parvi.	
10. Psoæ magni.	

b. INFLECTORS BACKWARD.

1. Trapezii,	when the shoulders are fixed.
2. Rhomboidei,	
3. Latissimi dorsi,	

4. Serrati postici superiores, } when the ribs are
5. Serrati postici inferiores, } fixed.
6. Sacro-lumbales.
7. Longissimi dorsi.
8. Spinales dorsi.
9. Semispinales dorsi.
10. Multifidi spinæ dorsi et lumborum.
11. Intertransversales lumborum.
12. Quadrati lumborum.

CHAPTER V.

Of the Articulations of the Head, Spine, and Thorax.

§ 1. ARTICULATION OF THE LOWER JAW.

This articulation has two lateral ligaments; a capsule of synovial membrane, and an interarticular cartilage.

1. External Lateral Ligament. *Ligamentum maxillæ laterale externum.* Consists of strong perpendicular fibres, which arise from the posterior extremity of the zygoma, descend upon the synovial capsule, and are inserted into the outer side of the neck of the lower jaw.

2. Internal Lateral Ligament. *Ligamentum laterale internum.* Consists of a thin tendinous layer which arises from the styloid process of the temporal bone, passes obliquely downwards, outwards, and forwards, and is attached to the lower jaw, below the inferior maxillary foramen.

The Synovial Membrane. Forms a double sack, one of which is above and the other below the interarticular cartilage. It is continued above to the edge of the glenoid cavity, and below to the circumference of the condyloid process of the lower jaw, being so united, in the interval, to the interarticular cartilage, that the two cavities have no communication with each other. It is so loose as to admit of considerable and easy movement of the lower jaw.

The Interarticular Cartilage. Is of an oval figure, and is placed horizontally. It is hollowed out both above and below, and is thicker at the circumference than in the centre, and thicker behind than before, so as to adapt its upper surface to the articular eminence and glenoid cavity of the temporal bone.

Besides the ligaments above-mentioned, there is a process of condensed cellular membrane intermixed with some ligamentous fibres, and called the

LIGAMENT OF THE JAW AND OS HYOIDES. *Ligamentum stylo-mylo-hyoideum.* Which passes from the extremity of the styloid process to the posterior edge of the angle of the lower jaw, and thence sends a rounded elongation to the appendix of the os hyoides.

§ 2. ARTICULATIONS OF THE VERTEBRÆ IN GENERAL.

1. ANTERIOR COMMON LIGAMENT. *Ligamentum vertebrarum commune anterius.* Is a strong ligamentous band, composed of longitudinal fibres, which extends from the fore part of the foramen magnum along the fore part of the bodies of the vertebræ, and anterior surface of the sacrum as far as the os coccygis. It is thicker upon the fore part of the vertebræ than at the sides, and is more considerable in the middle of the vertebræ than towards the intervertebral substance. It is thinnest on the uppermost lumbar and lowermost cervical vertebræ, in order to allow a greater degree of motion of those parts. Besides this ligament there are oblique decussating fibres which run between the bodies of the vertebræ upon the intervertebral substance, and are sometimes distinguished by the name of Crucial Intervertebral Ligaments.

2. POSTERIOR COMMON LIGAMENT. *Ligamentum vertebrarum commune posterius.* Extends along the posterior surfaces of the bodies of the vertebræ within the vertebral canal, from the foramen magnum to the lower part of the lumbar vertebræ. Its breadth diminishes irregularly from above to below. In its descent it becomes broader over each of the intervertebral substances, diminishes between them upon the bodies of the vertebræ, and adheres firmly to their upper and under edges. It prevents the spine from being bent too much forwards.

3. INTERSPINOUS LIGAMENTS. Consist of thin membranous processes, extended between the bodies of the spinous processes, and of small rounded ligaments extended between the extremities of those processes.

4. INTERTRANSVERSE LIGAMENTS. Are small ligaments extended between the transverse processes of the undermost dorsal vertebræ.

5. CERVICAL LIGAMENT. *Ligamentum nuchæ.* Arises from the perpendicular spine of the occipital bone,

2 Inter-Spinous. One Supra.
and Infra-Spinous

Ligamentum Subflavum

descends on the back part of the neck, and adheres to the spinous processes of the cervical vertebræ.

6. Intervertebral Substances. Are the principal means of connection between the bodies of the vertebræ. They are highly elastic and of a ligamento-cartilaginous structure, and are composed of concentric layers, the edges of which are firmly fixed to the bodies of the vertebræ. The lamellæ are made up of oblique fibres, which decussate with each other, and are united by fibres which pass between them. Between the layers a soft gelatinous and incompressible substance is interposed; it is in small quantity at the circumference, but increases towards the centre; and the centre-part itself consists entirely of this substance, and serves as a pivot for the motions of the spine. The strength of this structure is such, that under injury to the spine it is found that the bone will break sooner than this substance will give way. The intervertebral substances are thicker in the centre than at the circumference, and their thickness increases from above downwards.

7. Elastic Ligaments. *Ligamenta arcuum subflava.* The arches of the vertebræ are connected by means of a very elastic and yellowish ligamento-cartilaginous structure. This substance fills up the spaces between the arches, completes the back part of the vertebral canal, and affords a very strong mode of union, but which at the same time admits of a considerable degree of motion.

8. Capsules of the Articular Processes. The surfaces of the articular processes are covered with cartilage, and are provided with capsules of synovial membrane, which are strengthened on the exterior by ligamentous fibres.

§ 3. ARTICULATION OF THE HEAD WITH THE FIRST AND SECOND VERTEBRÆ, AND OF THOSE VERTEBRÆ WITH EACH OTHER.

In order to display the connection of these parts, the head with the first and second vertebræ should be separated from the rest of the spine. The occipital bone should then be cut so as to lay open the foramen magnum from behind, and the vertebral canal should be opened by cutting away the back part of the arches of the first and second vertebræ.

The ligaments which connect the occiput to these vertebræ, are

a. BETWEEN THE OCCIPUT AND ATLAS.

1. ANTERIOR LIGAMENT. Is a continuation of the anterior ligament of the spine. It is a broad ligamentous expansion, which is continued from the anterior arch of the atlas to the anterior edge of the foramen magnum.

2. POSTERIOR LIGAMENT. Is a similar broad but thinner ligamentous expansion, which is extended between the posterior arch of the atlas to the posterior edge of the foramen magnum.

3. CAPSULAR OF THE ARTICULAR SURFACES. Each of these surfaces has a synovial membrane, which is strengthened on the exterior by ligamentous fibres.

b. BETWEEN THE OCCIPUT AND THE VERTEBRA DENTATA.

1. PERPENDICULAR LIGAMENT. *Ligamentum rectum medium.* Extends from the point of the dentiform process of the second vertebra to the edge of the foramen magnum. It consists of straight fibres, but which are frequently not very strong nor distinct.

2. LATERAL LIGAMENTS. *Ligamenta lateralia.* Arise from the sides of the processus dentatus: they pass obliquely upwards and outwards, and are fixed to the inner edge of the foramen magnum. They are short, but strong, and have a rounded form.

c. OF THE ATLAS.

1. TRANSVERSE LIGAMENT, *Ligamentum atlantis transversale.* Is composed of transverse fibres, which arise from one side of the atlas, pass across behind the processus dentatus, and are fixed to the opposite side of the atlas. Between it and the dentiform process is a synovial capsule.

The edges of this ligament extend upwards and downwards, and form two processes called its *appendices,* which are fixed to the foramen magnum and processus dentatus.

d. BETWEEN THE FIRST AND SECOND VERTEBRA.

The articulating surfaces are connected by loose synovial

or The Anterior Occipito-Atlantoidean or
Circular Ligament.

the Posterior Occipito-Atlantoidean or
Circular Ligament.

the Occipito-Axoidean Ligament.

Alar Ligaments.

membranes, which are strengthened on the exterior by ligamentous fibres, which extend between the bones.

§ 4. ARTICULATION OF THE RIBS.

a. Of the Ribs with the Vertebræ.

The heads of the ribs are each united to the sides of the bodies of the vertebræ by two ligaments.

1. Anterior Radiated Ligament. *Ligamentum radiatum anterius.* The fibres of which this ligament is composed, pass in different directions from the sides of the bodies of every two vertebræ, and over the head of the rib to the front of which it is attached. It is often called the Capsular Ligament.

2. Interarticular Ligament. *Ligamentum interarticulare.* This is a little band extending from the intervertebral substance to the head of the rib to which it is attached, and divides the articulation into two distinct cavities lined by synovial membrane.

The tubercles of the ribs are united to the transverse processes of the vertebræ by synovial capsules, and the junction is strengthened by three ligaments.

1. Posterior External Costo Transverse Ligament. *Ligamentum costo transversale posticum.* Passes from the posterior part of the point of the transverse process upwards, and is inserted into the rib a little to the outer side of the tubercle.

2. Inferior Internal Costo Transverse Ligament. *Ligamentum costo transversale inferius.* Passes from the under edge of each transverse process into the upper part of the neck of the rib below that with which the process is connected.

3. Middle Costo Transverse Ligament. *Ligamentum costo transversale medium.* It cannot be seen but by cutting away the posterior ligament, and it then appears connecting the front of the transverse process with the neck of the rib.

b. Of the Ribs with the Sternum.

The greater number of the ribs are connected with the sternum either mediately or immediately by means of their cartilages. The cartilage of the first rib is inseparably united with the uppermost bone. Those of the six lower true ribs are adapted by articular surfaces, and are connected by means of capsules of synovial membrane. These are strengthened on the exterior by ligamentous bands, which arise from the extremities of the cartilages, are continued before and behind the articulation, and spread upon the sternum. There are also shining ligamentous bands, which extend upon the cartilages and connect them together.

§ 5. LIGAMENTS OF THE STERNUM.

MEMBRANES OF THE STERNUM. *Membrana ossium sterni anterior et posterior.* Are firm aponeurotic expansions, composed of fibres which run in different directions, but chiefly in a longitudinal one, and cover the anterior and posterior surfaces of the bone.

SECTION IV.

THE DISSECTION OF THE ABDOMEN AND PELVIS.

CHAPTER I.

Of the Muscles of the Abdomen, and of the Parts of Inguinal and Femoral Hernia.

§ 1. OF THE EXTERIOR OF THE ABDOMEN.

IMMEDIATELY beneath the common integuments of the Abdomen is found a strong layer of condensed cellular membrane, which has been called the *Fascia Superficialis*, or aponeurosis of the external oblique muscle; it does not differ from the cellular texture which connects the skin to the subjacent parts in the other regions of the body, except in its greater density; but it is of importance in herniæ, and should therefore be particularly attended to, and not dissected off with the skin, as is usual in other parts. Behind it are found, in the

ABDOMINAL REGION, five pairs of muscles.

1. M. OBLIQUUS EXTERNUS ABDOMINIS, *descendens*.

Situation. Its muscular portion covers the lateral parts, and its tendinous portion is expanded over the front of the abdomen. It forms the first layer.

For the purpose of dissecting it, an incision should be carried from the cartilago ensiformis to the os pubis, and a second obliquely downwards and forwards in the course of the fibres, from the margin of the ribs to the first incision.

Origin. By eight heads from the eight inferior ribs, of which the lower are received between the fleshy digitations of the serratus magnus. It is connected above to the pectoralis major, adheres to the intercostales, and is covered below and behind by the latissimus dorsi, where it extends between the last rib and the spine of the ilium. From these attachments the fibres of the muscle run obliquely downwards and forwards, and terminate in a thin broad tendon, the fibres of which are continued in the same direction.

Insertion. By joining with its fellow at the linea alba, which extends from the cartilago ensiformis to the os pubis; into the os pubis on the same side on which it arises, and into the opposite os pubis; and into the fore part of the spine of the ilium. The lower part of the tendon unconnected, extends between the anterior and superior spinous process of the ilium, and the projecting part of the os pubis, near to the symphysis, forming a strong rounded margin, which does not become distinct until the fascia lata of the thigh, which is connected with it, has been detached; this has been called *Poupart's* or *Fallopius's ligament*, or the *Crural Arch.* It has also another attachment to the os pubis, which extends from the inner and back part of Poupart's ligament, called *Gimbernat's ligament*, but which cannot be readily seen in this stage of the dissection.

Use. To support the abdominal viscera; to assist in the evacuation of the fæces and urine, and in the exclusion of the fœtus, and also in vomiting; to draw down the ribs in exspiration, and to bend the body forwards : these are the effects produced when both muscles act, but if either act alone, the body is swayed obliquely to that side.

When the external oblique muscle has been completely dissected, it will be seen that it is fleshy only at the upper part and sides, and that it is tendinous at the lower and anterior part.

On the tendinous portion are presented several distinct lines: these are,—the *Linea alba,* or WHITE LINE, already mentioned, which extends from the ensiform cartilage to the pubes, and is formed by the intermixture of the tendons of the oblique and transverse muscles: the *Linea semilunaris,* or SEMILUNAR LINE, so called from its curved direction, which is situated on the outside of the rectus muscle, and is formed by the connection of the tendon of the external oblique at that part with the tendons of the internal oblique and transverse muscles: and the TRANSVERSE LINES, or *Lineæ transversales,* so called from their passing transversely between the linea alba and semilunaris; these are produced by the con-

x The External abdominal Ring

nection of the tendon of the obliquus externus with the tendinous intersections of the rectus muscle beneath; there are generally three, one opposite to the cartilage of the seventh rib, one opposite to the umbilicus, the third in the middle between these; and there is commonly a half line below the umbilicus.

There are also ~~several~~ three openings in the tendon of the obliquus externus. One of these is the NAVEL, or *Umbilicus*, situated in the middle of the linea alba, originally the passage for the umbilical cord. The second ~~is~~ are the EXTERNAL ABDOMINAL RINGS, *Annuli Abdominales Externi*, or the passages for the spermatic cord in the male, and for the round ligament in the female, which ~~is~~ are found one on each side extending obliquely upwards and outwards above the spinous process of the os pubis. ~~This latter~~ is not annular in its figure, as its name might imply, but is formed by the separation of the tendinous fibres of the external oblique muscle. The fibres which form the inner margin or column of the ring, generally decussate with the corresponding fibres of the opposite side, and are fixed to the opposite os pubis near the symphysis: those which constitute the outer margin or column form a rounded cord, and are attached to the spinous process of the os pubis; the columns above the cord are connected by tendinous fibres, which run transversely. The boundaries of the abdominal ring are not distinctly seen, till a quantity of cellular substance has been removed, which surrounds the cord or round ligament, and assists in filling up the aperture. Besides these openings there are frequently separations of the tendinous fibres at other parts, and small apertures for the passage of blood-vessels and nerves.

2. M. OBLIQUUS INTERNUS ABDOMINIS, *ascendens*.

Situation. Forms the second layer of abdominal muscles. In order to display it, it is necessary to detach the external oblique muscle from the ribs, and from the spine of the ilium, and to reflect it forwards.

Origin. It is united behind with the broad tendon of the latissimus dorsi and serratus posticus inferior, which arises from the spinous processes of the sacrum and of the lumbar vertebræ, and by which therefore it is connected to these parts. It is usually said to arise from the sacrum, and from the spinous processes of the three lowest lumbar vertebræ. It is connected at the back part of the abdomen with the tendon of the transverse muscle. It arises also from the whole length of the spine of the ilium, and from the outer half of Poupart's ligament internally. From these origins the fibres of the muscle spread somewhat like a fan on the side of the abdomen, the superior run obliquely upwards, the middle pass nearly transversely, and the lowest are continued obliquely downwards and forwards towards the os pubis. The fleshy fibres terminate anteriorly in a broad tendon, which passes behind the tendon of the external oblique to the edge of the rectus, and there splits into two layers, one of which passes before and the other behind the rectus muscle. The lowest fourth of the posterior layer is not, however, continued behind the rectus, but passes with the anterior layer before that muscle. The posterior layer should not be examined until after the rectus has been dissected.

Insertion. Into the ensiform cartilage, and into the cartilages of the six lowest ribs; but the tendon at the upper part is extremely thin, and resembles cellular membrane. It is connected to the whole length of the linea alba, and is inserted below into the os pubis.

Use. To assist the former muscle, but it bends the body in an opposite direction.

From the lower edge of this muscle arise some pale fibres which pass upon the cord, and assist in forming the *Cremaster muscle.*

3. M. Transversalis Abdominis.

Situation. Forms the third layer of abdominal muscles. It is displayed by reflecting the internal oblique from its attachments to the cartilages of the ribs, to the tendon of the latissimus dorsi, and the spine of the ilium: its fibres run transversely.

Origin. Fleshy from the cartilages of the seven lowest ribs internally, where it intermixes with the diaphragm and intercostal muscles: by a broad tendon from the transverse processes of the twelfth dorsal, and four superior lumbar vertebræ; from the inner labium of the spine of the ilium, and from the outer half of Poupart's ligament. At this part the muscle is intimately connected with the internal oblique. The fibres pass transversely forwards, and terminate in a broad tendon, which, except the lower portion, is continued behind the rectus muscle. The lower portion joins with that of the internal oblique, and passes before the rectus; there are, however, some fibres observed behind the rectus.

Insertion. Into the ensiform cartilage: into the whole length of the linea alba, and into the os pubis.

Use. To support and compress the abdominal viscera.

Some of the fibres of the *Cremaster muscle* are derived also from this muscle. The spermatic cord, or round ligament,

passes obliquely under the edges of the internal oblique, and the transverse muscle.

If the lower portion of the transverse muscle be raised from the ilium and Poupart's ligament, it will be found lined posteriorly by an aponeurosis, which has been called by Sir A. Cooper, the *Fascia Transversalis*; and in tracing this fascia towards the pubes, an aperture, called the INTERNAL ABDOMINAL RING, *Annulus Abdominalis Internus*, will be discovered in it about midway, between the anterior and superior spinous process of the ilium, and spinous process of the os pubis, forming the passage of the spermatic vessels and vas deferens. The dissection of these parts is connected with the anatomy of hernia; and in consequence of their importance, a more accurate and detailed account of their structure will be found at page 232.

4. M. RECTUS ABDOMINIS.

Situation. On the fore part of the abdomen, between the linea alba and linea semilunaris. It is contained in a sheath, which is formed, on the fore part, by the tendon of the external oblique, and by the anterior layer of the tendon of the internal oblique; and, on the back part, by the posterior layer of the tendon of the internal oblique and by the tendon of the transverse muscle. The sheath should not be examined till the muscle has been dissected. The fore part of the sheath is now to be divided down its middle from above to below, and is to be separated from the surface of the muscle.

Origin. From the cartilages of the three lowest true ribs, and descends by the side of the linea alba. It has tendinous intersections, as has been already noticed, of which there are three usually complete, and a fourth that is continued only half across the muscle. They vary, however, in number, and seldom penetrate through the whole thickness of the muscle. They adhere firmly to the anterior part of the sheath.

Insertion. By a short flattened tendon into the os pubis, near the symphysis.

Use. To compress the fore part of the abdomen, and to bring the chest forwards; it also acts as a muscle of exspiration. In consequence of its tendinous intersections, the different portions can act separately upon the viscera placed immediately behind.

5. M. PYRAMIDALIS.

Situation. On the lower part of the abdomen immediately above the os pubis. Is frequently wanting on one or both sides.

Origin. Broad from the os pubis, near the symphysis. It runs up along the inner edge of the rectus muscle, covered by the anterior part of the sheath of the rectus, and gradually contracting its breadth.

Insertion. Tendinous, into the linea alba, about midway between the umbilicus and pubes.

Use. To assist the lower part of the rectus.

The *sheath of the rectus* may now be examined, by cutting the muscle across the middle, and reflecting the divided portions from the subjacent parts. It will be seen that the tendon of the internal oblique splits into two layers, one of which passes before the muscle with the tendon of the external oblique, and the other passes behind the same with the tendon of the transversalis: except at the lower part, where from the pubes to about midway between the pubes and umbilicus, the posterior layers also pass before the muscle, leaving the back part of the sheath incomplete.

After the student have dissected the abdominal muscles, and understand their attachments, it is highly important that he should examine with great care the lower part of their connection with the pelvis, which may be bounded above by a line drawn from the superior anterior spinous process of one ilium to that of the other. Below this line are the parts which have particularly to do with the passage of the spermatic cord from the abdomen, and as herniæ frequently protrude through this canal, the parts connected with it are usually called

§ 2. THE PARTS OF INGUINAL HERNIA.

The dissection is to be begun by making an incision upwards in the course of the linea alba, from the pubes to a point opposite the anterior and superior spinous process of the ilium, and another transversely to meet it from that process; the integuments are then to be turned back as far as the groin: this will bring into view a layer of that kind of cellular membrane before described, which has been named the *aponeurosis of the external oblique;* in tracing it downwards it will be observed to extend over the groin, and to adapt itself to the spermatic cord in passing down upon it, and if a blowpipe be inserted under it at that part, the air thrown in will be found to raise it to the lower part of the testis.

In order to display the *lower portion of the external oblique muscle*, a flap of the aponeurosis, like that of the integuments, is to be dissected back, as low down as *Poupart's ligament*, which is a portion of the tendon of the external oblique muscle, stretched between the *spinous process of the os pubis* and the *anterior superior spinous process* of the ilium.

The edge which it forms at this part is, however, indistinct, as will be hereafter explained. Above, and a little to the outer side of the spinous process of the os pubis, the fibres of the tendon of the external oblique, interlaced as it were by other tendinous fibres, separate to form an opening which is called the ABDOMINAL RING, or to distinguish it from another opening presently to be spoken of, the *external* abdominal ring; it is, however, neither round, nor does it seem an opening, being occupied in some measure by cellular membrane. Through it the *spermatic cord* in the male, and the *round ligament* in the female pass from the parietes of the abdomen, the former to the scrotum becoming invested at this part as before described by the aponeurosis of the external oblique, and the latter to terminate in the mons veneris.

The next part of the dissection consists in tracing the oblique course of the cord from its quitting the abdomen to the part where it appears externally. This is to be done by carrying an incision from a little above the external abdominal ring, in a somewhat semicircular direction outwards to the opposite and near the anterior superior spinous process of the ilium. Detaching then the tendon from the parts behind, above and below, the lowest fibres of the *internal oblique* will be seen, particularly those which pass from the outer half of Poupart's ligament to the pubes, being however neither strong nor numerous. Beneath the under edge of the internal oblique the spermatic cord passes obliquely to the external opening, acquiring here a part of its muscular covering, some of the fibres of the *cremaster muscle* being given off from the internal oblique. An incision through the internal, like that through the external oblique, shows the *transversalis muscle* disposed much in the same way as the internal oblique, its fibres few and weak, where arising from Poupart's ligament, and becoming tendinous towards the pubes behind the external opening. The rest of the cremaster not furnished by the internal oblique is derived from the transversalis. It will be evident from the foregoing description, that if a blunt instrument be passed through the external abdominal ring, it will be prevented from passing into the abdomen by the interposition of the tendon of the transversalis muscle. The fibres of the transversalis are now to be cautiously raised, beginning near to the spinous process of the ilium, and cutting through the cremaster. A *fascia* will then be found to line its posterior surface, composed of two portions; that on the outer side of the spermatic cord is of considerable thickness near to the ilium; and that on the inner side of the cord springs from the pubes, descends behind Poupart's ligament on the femoral vessels, and is slightly attached to Poupart's ligament: these together form the Fascia Transversalis. In tracing the spermatic cord towards the abdomen, it seems to disappear about midway between the spinous process of the pubes and the ilium; by insinuating a blunt instrument along the cord, and detaching the cellular membrane from around it, it will be found to pass through an opening in the fascia above described, which has been called the Internal Abdominal Ring. This opening is lined posteriorly by the peritonæum, and it is here that the spermatic cord is formed, the vas deferens passing down into the pelvis, whilst the spermatic vessels and nerves are derived from above.

The relation then of the internal abdominal ring to the external ring, is, that whilst the latter is situated at the spinous process of the os pubis, the former is placed midway between the spinous process of the bone and the anterior superior spinous process of the ilium, at the distance of an inch and a half from it, and above a line which is drawn from the top of the external opening horizontally outwards. The space between the two openings is called the Inguinal Canal. Consequently the *direction of the spermatic cord* within the canal will be inwards, downwards, and somewhat forwards; in its course passing under the edge of the internal oblique and of the transversalis muscle, deriving from these its muscular covering, the cremaster, and receiving after it has passed the external opening, a further covering from the aponeurosis of the external oblique.

The *epigastric artery*, in taking its course, from its origin at the external iliac, inwards and upwards to the rectus, is situated a little to the inner side of the internal ring, and is placed behind, and to the inner side of the cord, crossing it at a right angle.

Of the Parts of Inguinal Hernia in the Female.

In the female the *round ligament* occupies the place of the spermatic cord of the male in the inguinal canal. From being smaller the parts through which it passes are more contracted, but are better seen and more easily developed than in the male.

Practical Points.—The reduction of inguinal hernia—the adaptation of trusses—the operation for strangulated inguinal hernia.

§ 3. OF THE PARTS OF CRURAL HERNIA.

The *parts concerned in crural hernia* are chiefly those which are connected with the passage of the vessels at the groin, and they must be examined previous to the dissection of the muscles of the thigh.

The study of this part of anatomy should be begun by examining the manner in which the thigh is separated from the abdomen; and, at the same time, the mode in which they communicate. The peritonæum is to be removed from the lower part of the abdomen; then behind and below Poupart's ligament, (which has also received the name of the *Crural Arch,)* the *opening* may be perceived by which the iliac vessels are passing from the posterior part of the abdomen to the upper and anterior part of the thigh. This opening is chiefly occupied by the *femoral artery,* and on its pubic side by the *femoral vein;* to the inner side of the vein one or more *absorbent glands* will be found. The space around the opening between the body of the os pubis and Poupart's ligament is filled up:—*Behind,* by the *psoas* and *iliacus muscles* and the fascia covering them. This, the FASCIA ILIACA, is attached to the inner labium of the crista of the ilium, extends behind the iliac vessels, and on the inner side of these is attached to the linea ilio-pectinea; it is found particularly firm where assisting to shut up the abdomen at the outer part of the iliac vessels behind the crural arch, and sends a *portion with the femoral vessels* into the thigh:—*Before,* by the FASCIA TRANSVERSALIS, which has been already spoken of as forming the internal abdominal ring, in describing the parts connected with inguinal hernia. After lining the posterior part of the abdominal muscles, and being closely attached to the crural arch, the fascia transversalis unites on the outer side with the fascia iliaca between the anterior superior spinous process of the ilium, and the iliac vessels, the place of their junction being marked by a white line; on the inner it extends to the pubes, but becomes thinner and less distinct, and it sends out a *process* which descends behind the crural arch and passes before the femoral vessels into the thigh. The portion of the fascia iliaca which passes with the femoral vessels from behind, and the portion of the fascia transversalis which passes with them from before, seem by their union at the sides to form the FEMORAL SHEATH; this at the beginning is of a funnel shape, but is flattened from before to behind, and it becomes contracted a little below the crural arch. The Fascia Transversalis is said to extend as far as the hole in the tendon of the triceps femoris; but the Fascia Iliaca not further than the origin of the arteria profunda from the femoral artery.

By detaching the sheath from its connections on the pubic side, it will be found that to the inner side the space behind the crural arch is narrowed by a horizontal portion of tendon of a triangular figure, extending from the arch to the opposite part of the os pubis, and presenting a sharp edge towards the femoral vein: it is called *Gimbernat's ligament*, or the third insertion of the external oblique muscle.

The dissection is to be prosecuted by examining the relation and connection of these parts with those situated *externally*. After removing the integuments, that which has been called the *aponeurosis of the external oblique* may be traced extending over the groin, and descending upon the thigh: it covers the *inguinal glands*, which are clustered together at this part, and portions of it are dipping in between them. The aponeurosis may now be dissected back to display the FASCIA LATA, which will be seen attached to *Poupart's ligament*, rendering its rounded edge indistinct. But the fascia lata may be said to be composed of two portions at the upper part:—an outer and more dense one attached to nearly the whole extent of Poupart's ligament, which covers the muscles at the fore part of the thigh, and in a great measure the femoral vessels, but terminates upon them in a more or less distinct *crescent-shaped edge* (sometimes called the FALCIFORM PROCESS;)—and an inner, deeper seated and thinner portion attached to the pubes and its ligament, which covers the muscles at the inner part of the thigh, seems to pass behind the femoral vessels, and unites with the outer portion some little way below the crural arch. Through this *opening of the fascia lata*, thus formed by its two portions, a part of the sheath of the femoral vessels may be perceived; and the *vena saphæna major*, which rises up from the inner part of the thigh, may be traced to its termination at the femoral vein. When the absorbent glands are removed which are seated about this part, the inner side of the femoral sheath will be found to have numerous perforations; this FASCIA CRYBRIFORMIS, as it is sometimes called, allows of the communication between the inguinal absorbent glands and those situated within the sheath, but renders the fascia forming the sheath weaker at this part. The fascia lata being removed, the crural sheath appears, which contains the femoral artery and vein separated from each other by a *tendinous septum*; and the absorbent vessels may be seen entering the inner and upper part of the sheath. The *anterior crural nerve* is situated upon the muscles on the iliac side of the sheath, but the trunk of this nerve does not enter the crural sheath.

PRACTICAL POINTS.—The reduction of crural hernia—the adaptation of trusses—the operation for strangulated crural hernia.

CHAPTER II.

Of the Abdominal Viscera.

The parietes of the abdomen are formed by the lumbar vertebræ, the bones of the pelvis, the cartilages and ligaments belonging to them, the lumbar mass of muscles, the five pair of abdominal muscles, and the muscles at the outlet of the pelvis.

§ 1. OF THE CONTENTS OF THE ABDOMEN.

The Abdomen is the second, inferior, and larger cavity of the trunk. It contains the organs which are subservient to the digestive process, or the *chylopoietic viscera;* the *urinary organs* which secrete, retain, and convey the urine; and a part of the *organs of generation.*

Regions of the Abdomen. The Abdomen is arbitrarily divided into different regions. 1. The Epigastric, which is all that part situated above a line drawn from the last rib on one side transversely to that on the opposite side. This again is subdivided—into a middle region, called the *scrobiculus cordis,* bounded at the sides by the edges of the cartilages of the ribs, and superiorly, by the cartilago ensiformis; and into two lateral regions, covered by the cartilages of the ribs, and hence called the *hypochondriac.* 2. The Umbilical, which is bounded, above, by the transverse line between the extremities of the last ribs, and, below, by one drawn between the superior anterior spinous processes of the ilia. This likewise is subdivided into three others by a line drawn on each side perpendicularly upwards from the superior anterior spinous processes to the line bounding this region superiorly: the middle space retains the name of *umbilical,* the lateral spaces are called the *iliac regions.* 3. The Hypogastric Region, which comprises the inferior and remaining part of the abdomen. It is bounded, above by the line between the anterior and superior spinous processes of the ilia; and below by the pubes and groins. Its subdivision is supposed by a line on each side drawn perpendicularly upwards from the spinous processes of the ossa pubis to the upper boundary: the middle space is called the pubes, or *pubic* region; the lateral regions are called the *inguinal*. 4. The LUMBAR: the posterior part of the abdomen between the ribs and ilia is divided into the right and left *lumbar* regions.

PERITONÆUM. The abdominal muscles may next be carefully dissected off, to the extent of a few inches about the umbilicus; and this will enable us to display as far as is necessary the thin membrane, called the peritonæum, which lines the parietes of the abdomen, and gives a covering to its contents. Interposed between the muscles and the peritonæum, we shall find the remains of the umbilical vessels which convey the blood to and from the fœtus in utero, and are called the *ligaments of the peritonæum*. They consist of the remains of the *umbilical vein* which passes upwards from the umbilicus, and may be traced to the liver; the remains of the two *umbilical arteries* which pass downwards from the umbilicus, and terminate at the internal iliac arteries; to which add the *urachus*, which in the human subject is nothing more than a cord (in some instances an imperfect canal) passing downwards towards the bladder.

The cavity of the abdomen is next to be laid open by one incision, which is to be carried from below the cartilago ensiformis to the pubes, and by a lateral incision extended from the umbilicus to the crista of the ilium on each side.

The *peritonæum*, like the pleura and pericardium, (see p. 195,) is a membrane of the reflected kind. After lining the parietes it is reflected from them, covering the different viscera and their vessels contained within the abdomen, and assists in retaining them in their situation. It is without any opening, so that if it could be raised from the viscera which it envelopes, and from all the parts to which it is attached, it would form a large bag, and it would be seen that the viscera are, in appearance only, contained within it.

The external surface, by means of which it is attached to the parts it covers, is of a loose cellular texture.

Its internal surface is smooth, and without any attachment; and allows therefore of motion between the viscera and itself. It is moistened by a secretion from its internal surface, which in the dead subject is condensed into a clear serous fluid. The peritonæum is semi-transparent and thin, but of considerable firmness. Its structure, which may be demonstrated by maceration, consists of pale, delicate membranous filaments matted together, resembling the structure of the other serous membranes.

§ 2. SITUATION OF THE CHYLOPOIETIC VISCERA.

On opening the abdomen, as above directed, four parts come into view: the stomach, the liver, a portion of the gall-bladder, and the omentum: and if the omentum be short, the small intestines are in part seen.

Liver. Occupies nearly the whole of the right hypochondrium; and crossing the scrobiculus cordis extends a little into the left hypochondrium. Its anterior edge is situated immediately behind the edge of the cartilages of the ribs.

Stomach. Is situated at the upper and left part of the abdomen. It is a muscular bag, which is capacious and rounded at one extremity, and gradually decreases to the opposite. It is the continuation of the alimentary canal between the extremity of the œsophagus and the beginning of the intestines. It occupies nearly the whole of the left hypochondrium, and extends into the epigastrium.

It is divided externally into two surfaces, an *anterior* and a *posterior*; two curvatures, a *greater* and a *less*; and two extremities, a *right* and *left*, or cardiac and pyloric. It has likewise two openings formed by the cardia and pylorus, and called the *cardiac* and *pyloric orifices*. The greater curvature is convex, forms the inferior edge, and reaches from one extremity to the other; and a process of the peritonæum is attached to it. The lesser curvature is concave, and is comprehended between the pyloric and cardiac orifices; the peritonæum is attached to it in the same way as to the greater. The left extremity comprehends all that portion of the stomach which is to the left of the œsophagus: it forms a large cul-de-sac below the cardiac orifice. The cardiac opening forms the communication with the œsophagus; and is situated higher and more posteriorly than the pyloric orifice. The situation of the pyloric orifice, which forms the communication with the intestines, is marked by a circular depression and a sensible thickening. It is lower, and more forwards than the cardiac orifice. The direction of the stomach is transverse, but with such a degree of obliquity that the anterior surface is higher than the posterior; the left extremity higher and more posterior than the right; and the lesser curvature posterior to, at the same time that it is higher than, the greater.

Course of the Intestines. Under the name of Intestinal Canal, or Intestines, is designated the muscular and membranous tube, beginning at the pylorus and terminating at the anus. It forms numerous turns and circumvolutions in the abdomen. Its length in the adult is in general six or seven times the length of the whole body. The intestinal canal is smaller at the upper part than at the lower, and in consequence has been divided into *small* and *large intestines,* each subdivided into three portions: the small into,—1. DUODENUM,—2. JEJUNUM, and 3. ILIUM: the large into,—1. CŒCUM,—2. COLON, and 3. RECTUM.

On turning up the omentum, the convolutions of the small intestines are seen, occupying a large portion of the abdomen; whilst a considerable part of the large will be observed to pass around them.

SMALL INTESTINES.

DUODENUM. So named from being about the length of twelve fingers' breadth; extends from the pylorus to the transverse mesocolon, forming a curve, of which the convexity is to the right, the concavity to the left; takes its course from the pylorus horizontally backwards, and to the right as far as the neck of the gall-bladder; then turns downwards in a curved direction to the left, surrounding the head of the pancreas, as far as the second lumbar vertebra; and lastly is continued transversely to the left, passing before the spine, and behind the root of the mesentery and mesocolon, by which it is fixed.

JEJUNUM AND ILIUM. The rest of the intestinal canal, belonging to the division of the small intestines, commences at the termination of the duodenum, at the root of the mesentery and mesocolon, and is extended to the large intestines. It forms numerous and closely contiguous circumvolutions, encircled by the large intestines.

The direction, taken from the origin of this portion of the intestinal canal to the termination, together with its folds of peritonæum, is obliquely from above to below, and from the left to the right. The principal circumvolutions have their convexity anteriorly towards the parietes, their concavity to the spine. They are distinguished by anatomists into *jejunum* (so called from being commonly found empty,) and *ilium* (named from its turns:) their extent is determined by measurement, two-fifths being assigned to the jejunum, and three-fifths to the ilium. The division, however, does not seem to have any natural foundation nor practical utility. The ilium terminates in the large intestines in the right iliac region, passing rather transversely, whilst the colon and cœcum are placed nearly perpendicularly.

The small intestines are attached to the parietes by means of the

MESENTERY. It is composed of two layers of peritonæum, which pass off from the posterior wall of the abdomen in an oblique line, from about the second lumbar vertebra to the iliac fossa. This attachment is straight and narrow; that towards the intestines is convex, broad, and coextensive with their length. The mesentery is narrow above, broad in the middle, and then becomes again gradually narrower towards the union of the ilium and cœcum. The two layers, like those of the other doublings of the peritonæum, are connected by a somewhat loose cellular membrane, containing some fat; and between them are situated the absorbent vessels and glands, and the blood-vessels of the intestines.

LARGE INTESTINES.

CŒCUM. So named from its forming a pouch or blind extremity. Is the first of the large intestines, occupying nearly the whole of the hollow of the right ilium, and attached to the iliacus muscle. It is situated below the colon, with which its superior part is continuous, and comprises all that portion which is below the entrance of the ilium. In this situation it is firmly fixed by the peritonæum.

COLON. It retains the Greek name, signifying intestine, and meaning any thing hollow. It passes upwards in the right lumbar region as high as the liver and gall-bladder; it then changes its direction and passes transversely across the abdomen, over to the left side; it descends in the left lumbar region as low as the left iliac fossa; it then forms a turn, of an S figure, and at the base of the sacrum becomes rectum. From thus changing its direction it has been divided into four portions:—1. *Ascending Colon,* 2. *Transverse Arch of the Colon,* 3. *Descending Colon,* 4. *Sigmoid Flexure of the Colon.*

1. The ASCENDING COLON is situated in the right lumbar region above the cœcum, below the gall-bladder; it is covered anteriorly by peritonæum, and is connected posteriorly with the quadratus lumborum and right kidney, by a quantity of cellular membrane. Sometimes, however, it is more loosely connected by the peritonæum passing completely round, and being continued between it and the parietes; in which case, the portion forming the attachment is called the RIGHT LUMBAR MESOCOLON, or the *right ligament of the colon:* this fold is continuous above with the transverse mesocolon, and terminates below behind the cœcum.

2. The Arch of the Colon occupies the lower and anterior part of the epigastric region; it is situated usually below the stomach, but passes across the abdomen, sometimes opposite to the navel, and sometimes lower, through the hypogastric region, and behind the anterior layer of the great omentum. It is the longest and largest portion of the divisions of the colon. It is united behind with the Transverse Mesocolon. This is a fold of peritonæum formed of two layers which pass transversely, and connect the colon with the posterior wall of the abdomen; it forms with the intestines a kind of partition of the abdominal cavity. Its figure is semicircular, being larger in the middle than at the sides, where the intestine is near to the parietes. Its inferior layer is continued with the mesentery, its superior passes over the pancreas and third turn of the duodenum, where they separate. On the left it is continued with the peritonæum of the parietes at the eleventh or twelfth rib, forming a fold below the spleen. On the right it is continued to the lumbar peritonæum above the kidney and behind the liver, to the right of the duodenum. The covering of the upper part of the duodenum is a continuation of the superior layer; but where the intestine passes across the spine, it is included between the two layers.

3. The Descending Colon. Before the left kidney and below the spleen; having the same relative situation, size, and connections, as the right; it has sometimes a Left Mesocolon.

4. The Sigmoid Flexure of the Colon. Situated in the left iliac fossa, is loosely attached by a double layer of peritonæum, called the Iliac Mesocolon.

Rectum. Occupies the posterior part of the pelvis. Its name is not correct in the human subject, as it is somewhat curved. At the superior opening of the pelvis it corresponds to the left psoas, is then inclined to the right, passes on the median line, at the lower part of its course, and terminates at the anus. It is covered and fixed by peritonæum, the extent of which will be seen in the dissection of the pelvis: it is sometimes continued behind the intestine, and forms a loose fold called the Mesorectum. We next proceed to the

Omenta. Of these there are two, a less and a greater.

Less Omentum. *Oment. gastro-hepaticum, membrana macilentior.* Extends between the lesser curvature of the stomach and the concave surface of the liver; it is fixed besides to the extremity of the œsophagus and to the diaphragm, to the pylorus, and the commencement of the duode-

num. It is placed before the lobulus Spigelii, which may be seen through it: and is composed of two layers of peritonæum, closely applied to each other, and connected by a very fine cellular membrane. Between these layers, at the right extremity, are situated the hepatic vessels and biliary ducts: and this is the part which is called the CAPSULE OF GLISSON. Behind Glisson's capsule is a rounded opening called the *Foramen of Winslow*. To prevent the mistake, to which the equivocal import of the word, foramen, might lead, it may be well to notice, that it is a mere aperture of communication between the general cavity of the peritonæum, and a lesser cavity, formed in part by the bag of the omentum.

GREAT OMENTUM. *Oment. gastro-colicum, membrana adiposa.* Is a bag attached at the upper part anteriorly to the greater curvature of the stomach, and posteriorly to the transverse arch of the colon. If a blow-pipe be introduced into the foramen of Winslow, the bag of the omentum may be inflated, unless (which is not uncommonly the case) adhesions have been formed. From these attachments it extends downwards, between the convolutions of the small intestines and the parietes of the abdomen, covering the former, more or less. It varies in size, in the adult often reaching into the pelvis. It is of a quadrilateral figure, and terminates below in a loose edge; to the right it is continued with the colic epiploon, to the left with the covering of the spleen and pancreas. It is formed of two layers of peritonæum; those which have been described as forming the little omentum separate at the less curvature of the stomach, the one passing before that viscus, the other behind; and at the greater curvature of the stomach they again become applied to each other, descend before the small intestines, are reflected upwards to the arch of the colon, where they separate to enclose it, after which they pass together to the spine, forming the transverse mesocolon and the lower boundary of the posterior cavity of the peritonæum. The two layers are connected by cellular membrane, which in the adult and in advanced age generally contains fat. In the young subject it is disposed in the course of the vessels, but afterwards becomes more uniformly diffused.

There is sometimes another fold of peritonæum, distinct; which is called Colic Epiploon, *Omentum colicum*. It is placed on the right side of the angle of union of the right with the transverse mesocolon. It is formed of two layers, and is merely an appendage of the peritonæal coat of the colon.

SPLEEN. The spleen is a spongy body of a purple livid hue, and of an oval figure, situated deeply in the left hypochondrium between the false ribs and stomach, below the diaphragm, above the colon and left kidney. It is connected to the diaphragm and to the left extremity of the stomach by a continuation of the peritonæum.

PANCREAS. It is best seen by tearing through the great omentum, between the stomach and colon. The pancreas is a conglomerate gland, situated in the posterior part of the epigastric region, nearly on a level with the twelfth dorsal vertebra, behind the stomach, above the transverse portion of duodenum, and before the vertebral column, the pillars of the diaphragm, and the aorta and vena cava. It is covered by a continuation of the superior layer of the transverse mesocolon. It passes transversely between the inferior portion of the spleen and the second turn of the duodenum, to the latter of which it is attached.

REFLECTION OF THE PERITONÆUM.

The situation of the viscera having been observed, the peritonæum may now be successively traced over those parts to which it gives a covering. As it forms a circumscribed cavity, it is immaterial at what part we commence, provided we trace it to the same point.

The Peritonæum, after quitting the lower part of the recti muscles, is continued over the fundus and posterior surface of the bladder; then passes on to the rectum, and is extended at the sides to the parietes of the pelvis. From the rectum it is continued onwards to the lumbar vertebræ; on the right side it covers the cœcum, and on the left encloses and attaches the sigmoid flexure of the colon. From the lumbar vertebræ it extends to the small intestines, forming the inferior or posterior layer of the mesentery; it passes round the small intestines, and returns to the spine, forming the superior or anterior layer of the mesentery. On the left side it is extended over the left kidney, and around the descending portion of the colon; on the right side it passes over a small portion of the right kidney and the ascending colon. After completing the mesentery it again quits the spine, and appears as the posterior or inferior layer of the transverse mesocolon. The anterior or superior layer of the mesocolon is a continuation of the peritonæum from the pancreas above: the two layers of the mesocolon pass to the colon, separate and enclose that intestine, again unite, and pass down as the posterior part of the bag of the omentum; they are then reflected upwards and forwards to the greater curvature of the stomach, forming the anterior part of the bag of the omentum. At the greater curvature

of the stomach, the two layers again separate; one passes over the anterior, and the other over the posterior surface of the stomach: at the lesser curvature they are connected, and, passing upwards to the concave surface of the liver and diaphragm, constitute the lesser omentum. The layers of the lesser omentum then separate: the posterior is continued over the posterior part of the concave surface of the right lobe of the liver, descends over the posterior wall of the abdomen and pancreas, and is continued with the upper layer of the transverse mesocolon: the anterior is continued from the left extremity of the stomach to the spleen, and having given it a complete covering passes to the parietes; but on the right side it passes over the left lobe and over the anterior part of the concave surface of the liver, round its edge, covers its convex surface, and is reflected from it so as to form the processes called the ligaments of the liver; it then lines the concave surface of the diaphragm, descends over the fore part of the parietes of the abdomen, and is continued down to the lower part of the recti muscles, from whence the tracing commenced.

Contents of Glisson's Capsule. May now be dissected by cutting through the peritonæum and clearing away the cellular membrane. They consist of the trunks of the hepatic artery, the vena portæ, the biliary ducts with the nerves and absorbent vessels and glands of the liver; intermixed with cellular substance. The *hepatic artery* is situated on the left; the *biliary ducts*, consisting of the *ductus hepaticus*, which passes down from the liver, the *ductus cysticus*, which is continued from the neck of the gall-bladder, and the *ductus communis choledochus*, which is formed by the union of the two, on the right; and the *Vena Portæ* behind and between them. The nerves and lymphatics surround the great vessels.

§ 3. STRUCTURE OF THE ALIMENTARY CANAL.

To dissect this properly, portions of the different intestines should be taken out from the body.

Œsophagus. Its course has been already seen in the neck and posterior mediastinum. See pages 185 and 197. It begins in the neck about the fourth or fifth cervical vertebra, and terminates at the cardia of the stomach, after having passed through the diaphragm.

It is formed of two tunics, a muscular and a membranous. The *muscular* is composed of two layers, an external, consisting of longitudinal fibres, which begin at the cricoid cartilage, are continued parallel to each other, and ultimately pass upon the stomach, where they become paler and diverge; and an internal one of circular fibres, fewer in number and connected by delicate cellular membrane to the former. The *membranous* has the structure of a mucous membrane, and numerous follicles for the secretion of mucus. It is distinguished by its paler appearance from the membranes of the pharynx and stomach, has numerous longitudinal plicæ, arising from the contraction of the transverse fibres, but disappearing when it is distended; and is lined by cuticle, which may be seen to terminate in a fringed extremity at the cardiac orifice of the stomach.

STOMACH. The stomach has been compared in figure to the bag of the bag-pipe. Its situation, position, and anatomical division, have been already described. See page 239. It has three coats: 1. peritonæal, 2. muscular, and 3. villous. 1. The *peritonæal* is a continuation of the peritonæum; two layers from the porta of the liver, after forming the little omentum, separate, and cover the anterior and posterior surfaces of the stomach; these, at the greater curvature reuniting, form the great omentum. 2. The *muscular coat* is the most considerable. It is composed chiefly of two orders of fibres, a longitudinal and a transverse. The longitudinal fibres take the course of the long diameter of the stomach, and seem to be chiefly continued from the œsophagus; they diverge at the cardiac orifice, and divide into different bundles, the most considerable passing along the less curvature, others descending upon the left extremity and taking the course of the greater curvature throughout its extent, whilst some, but fewer, pass upon the surfaces, intersecting obliquely the circular fibres. The circular order is more considerable: they are few at the cardiac portion of the stomach, but are many and well marked at other parts, especially in the middle: they are arranged parallel to each other, and appear to consist of segments of circles, rather than complete rings. 3. The third coat, the *villous*, or mucous, is a continuation of the lining membrane of the œsophagus, but differs from it in the minute projections which cover its surface, and from their resemblance to the pile of velvet, have given its name to the coat. It is of a reddish yellow colour, but sometimes the red appearance is so distinct, or inclining to purple, that much caution is requisite, especially where there is a suspicion of poison, before we can decide with safety that it has been produced by inflammation. This coat

is frequently found disposed in folds from the contraction of the muscular fibres. Most of these are longitudinal, some are transverse, and at the cardia they are radiated. It is connected with the muscular coat by a fine dense cellular membrane, which has been erroneously described as an expansion of nerve, and called the *nervous coat* of the stomach.

At the pyloric orifice is situated the *pylorus*, a kind of valve, corresponding to the external depression. It has the form of a broad flat ring, fixed by its circumference, which is thick, to the parietes of the stomach, and forming a round aperture by its internal thin edge. It is composed of a doubling of the mucous membrane, which encloses a bundle of muscular fibres, cellular texture, and a process of a substance so dense as to resemble cartilage, and which gives firmness to the projection. This valve shuts the stomach, during digestion, and prevents the too early passage of the food.

INTESTINES. - In order to examine the structure of the intestines, it will be found most convenient to remove them. They may be divided above, at the commencement of the jejunum, leaving the duodenum untouched, and below at the termination of the colon, after having applied two ligatures round the intestine at each part, and divided between. In dissecting them out of the abdomen, it should be done carefully, so as not to destroy more than is necessary: and in order to this, we should divide only the processes of peritonæum, by which they are retained. Portions then may be separated for dissection, viz. a part of the ilium for the structure of the small intestines, a portion of the arch of the colon for the structure of the large intestines; and the termination of the ilium, and the beginning of the colon and cœcum, in one piece, for the examination of the valve at that part. These portions are to be washed and inflated, and that which is reserved for the dissection of the valve dried.

SMALL INTESTINES. Their structure is similar to that of the stomach. They are cylindrical, and present a smooth and even surface externally. The external or *peritonæal* coat is a continuation of the peritonæum. It closely invests the intestines, except at the posterior part where the mesentery begins. At that part it is rather loosely connected by cellular membrane, but over the whole of the rest of the surface is intimately united by fine cellular membrane to the muscular coat. The *muscular coat* is composed of two sets of fibres: an external, in which the fibres are disposed longitudinally, are very minute, and most distinct on the convexity of the intestine; and an internal, consisting of transverse fibres, which form segments of circles, are stronger, more distinct, and numerous, than the longitudinal, and encompass the canal. The *villous*, or mucous *coat* of the intestines, presents the same appearance of villi as the internal membrane of the stomach, of which it is a continuation. It forms numerous duplicatures within the canal, called *valvulæ conniventes*: these are fixed transversely to the circumference of the intestine. They vary in breadth and length, but none of them form entire circles; and they are broader in the middle than at the end. The mucous coat is united to the muscular by a cellular texture, which was formerly called the nervous coat. The villi are more conspicuous than in the stomach; they are composed of arteries, veins, and nerves, and the mouths of the absorbent or lacteal vessels. In the cellular texture are found small round and oval glands of the follicular kind; but which are not distinct, except under disease. Some of these are clustered together, whilst others are met with singly; they have, therefore, according to these circumstances, been called the *glandulæ aggregatæ et solitariæ*, or from their discoverers, *Brunneri et Peyeri.*

DUODENUM. Is the largest, and seems capable of the greatest dilatation; whence it has been sometimes called a secondary stomach. It is closely fixed, especially its two lower portions, which give attachment to the pancreas. Its peritonæal covering is partial, being covered only anteriorly by the superior layer of the mesocolon, between the layers of which its transverse portion is included. Its muscular coat is stronger. Its villous coat presents a number of valvulæ conniventes; they begin about an inch from the pyloric orifice. Where the intestine becomes transverse, the ductus communis choledochus, and ductus pancreaticus, terminate upon the internal surface by a common orifice.

JEJUNUM. It differs from the duodenum in being less, and in having a weaker muscular coat; while the valvulæ conniventes, villi, and lacteals are much more conspicuous as well as more numerous.

ILIUM. It is still less in diameter; its coats are thinner; the valvulæ conniventes fewer and smaller; and the lacteals not so numerous.

LARGE INTESTINES. Their surface is not even, but disposed in different eminences. To different parts are attached the *appendices pinguidinosæ* or *epiploicæ*. These are small processes, formed of elongations of the peritonæal covering, which contain some cellular membrane and adipose matter.

They are sometimes placed in one or two rows, and in other instances are disposed without regularity; but generally are attached to the projecting parts of the intestines. The large intestines are composed of the same coats as the small intestines. The *peritonæal* covering is, for the most part, not so complete as that of the small. The *muscular* coat is thicker and stronger, and is composed of longitudinal and circular fibres. The circular have the same disposition as in the small intestines. But the longitudinal differ in length and disposition; they are collected together in three different bands, intermixed with tendinous fibres, commonly called *bands of the colon.* These bands, two of which are anterior, and one posterior, begin at the vermiform process of the cœcum, are continued the whole length of the colon, and are lost upon the rectum. They are shorter than the intestines, and therefore the colon and cœcum seem to be contracted, so as to give externally the appearance of eminences, and internally that of cells, *sacculi*. The villous appearance of the internal membrane is much less distinct. The mucous glands are more numerous than in the small intestines.

CŒCUM. The peritonæal covering is seldom complete at the part where the intestine is connected with the psoas and iliacus. To the right and posteriorly we find the *appendix vermiformis.* It is about the size of a large quill, and generally from two to three inches in length; is smooth externally, and enveloped in a proper covering of peritonæum. Its parietes are the same as those of the intestines, its cavity therefore inconsiderable. It terminates in a blind extremity. Its muscular coat is chiefly composed of longitudinal fibres, and its mucous membrane is continued from the cœcum.

VALVE OF THE ILIUM (valve of the colon; ilio-cœcal, ilio-colic valve, &c.) At the place where the ilium terminates in the cœcum and colon, there is a valve, to prevent the passage of the food from the large to the small intestines. If observed in a recent intestine, it appears like a rounded projection into the cavity of the large intestine; with a fissure in its middle, forming two lips, which are united at the extremities, are continued by folds on each side, and are insensibly lost on the sides of the intestine. If the cœcum be removed from the body, with the termination of the ilium and the beginning of the colon, and these inflated and dried, and if then an opening be made opposite to the termination of the ilium, it will be found formed of two semilunar flaps, which adhere by their convex edge to the termination of the ilium and to the parietes of the cœcum and colon, whilst their concave edges project unattached into the cavity. They are united at the extremities, and lost upon the parietes, as before stated. These two folds bound the orifice of the ilium; the inferior being the larger. The valve is formed by a projection of the internal membrane of the ilium doubled upon itself, and then continued with that of the cœcum and colon. Within this, chiefly in the inferior flap, are found some muscular fibres, of the circular order. The peritonæal covering does not enter into its structure, and, if it be cut through, the ilium may be drawn from the large intestines, so as to demonstrate the structure of the valve, while we deprive it of its valvular form. Within the folds that form the lips are some whitish firm fibres of a tendinous structure, called the *retinacula* or *fræna Morgagni.*

Colon. It has the same structure and appearance as the cœcum. Its peritonæal covering is seldom found complete on the ascending and descending portions.

Rectum. It will be examined most conveniently after the dissection of the pelvis. See page 269. It is cylindrical: not so capacious as the colon, but occasionally found exceedingly enlarged from accumulated fæces; and it is always somewhat larger just above the anus. Its external surface does not present the eminences of the colon, for the longitudinal fibres are equally dispersed and not collected in fasciculi. The *peritonæal* covering is most often defective at the posterior part of the rectum, and, in its lowest third, is wholly wanting. This covering is liable to vary from the varying size of the surrounding organs: thus it will be less covered under the enlarged state of the uterus, and in some degree under excessive distension of the bladder. The *muscular* coat is considerably thicker and stronger, the longitudinal fibres are *spread* over the intestine, *not collected in fasciculi*, and are lost towards the extremity. On the other hand, the circular are particularly strong towards the extremity, and are sometimes called the *internal sphincter.* The *mucous* coat is somewhat thicker and redder; its internal surface is disposed in longitudinal and transverse folds, called the *columns of the rectum*, the most remarkable of which are at the inferior part. These folds are caused by the contraction of the circular fibres. The mucous glands are found in greater abundance.

§ 4. OF THE LIVER.

The liver may first be examined *in situ*, in order to become acquainted with its attachments. These are called the *Liga-*

ments of the Liver, five in number, which are, except the round ligament, productions of the peritonæum:—The *suspensory ligament* consists of two layers of peritonæum, which pass from before to behind, and are continued from the diaphragm to the convex surface of the liver, so as to divide it into right and left portions. At its anterior edge, between its layers, are contained the remains of the umbilical vein, which thus passes to the liver on the exterior of the peritonæum; it is called the *round ligament.* The layers of the suspensory ligament separate from each other behind, leaving a triangular space filled by cellular membrane, and, at this part, are called the *coronary ligament;* while under the name of the *right* and *left lateral ligaments*, they are continued on each side along the posterior margin of the liver, and connect it to the diaphragm.

The liver may now be taken out, by cutting through the ligaments, and through the ductus communis choledochus, hepatic artery, and vena portæ, leaving still the duodenum and pancreas *in situ.*

The liver is the largest gland in the body; of a dusky red colour; its average weight, in adults, about three pounds; its figure irregular; and its *superior surface* convex, fitting the concavity of the diaphragm. This surface is divided by the suspensory ligament into two unequal parts; that to the right called the *Right or Great Lobe*—that to the left, the *Left or Small Lobe.* The inferior surface is of less extent than the upper; irregularly concave, and rendered unequal by different cavities and projections. These are:—1. To the left, a slightly concave surface, corresponding to the stomach. 2. The Great Fissure, or *Fossa Umbilicalis*, dividing the under surface into the right and left lobes, passes from the anterior to the posterior edge: it is often crossed anteriorly by a process of the liver, thence named *Pons Hepatis*, so as to render a part of it a complete canal. It lodges anteriorly the umbilical vein, and posteriorly the ductus venosus; both of which are of a ligamentous texture. 3. The *Porta*, or *Sulcus Transversus*, which is not so long as the last, passes from left to right in the direction of the transverse diameter of the liver, of which it occupies about the middle third: it is situated at nearly an equal distance from the anterior and posterior edges of the viscus, and at right angles with the last fissure: its depth is considerable, especially in the middle. It contains the trunk of the vena portæ, the principal branches of the hepatic artery, the biliary ducts where they form the ductus hepaticus, and the nerves and absorbents of the liver: these are united by a close cellular membrane. 4. The eminences of the porta, which are two in number: the one, the *Lobulus Quadratus*, so named from its figure, which bounds anteriorly the porta, and separates the anterior half of the longitudinal or great fissure from the depression in which the gall-bladder rests; the other, called the *Lobulus Spigelii*, is more considerable than the last, and is seen through the little omentum. It varies in figure, but is generally of a triangular or quadrilateral form; it bounds the porta posteriorly. Two processes extend from it; one, called the *Lobulus Caudatus*, extending on the surface of the larger lobe, and separating two depressions afterward to be spoken of; while the other extends to the posterior margin, and assists in forming a canal or depression for the passage of the vena cava inferior. 5. A superficial oval depression, on which part of the gall-bladder lodges, situated to the right of the lobulus quadratus, and without peritonæum. 6. Two less depressions on the right lobe, the anterior answering to the union of the right lumbar colon with the arch; the posterior to the superior extremity of the right kidney and capsula renalis.

The *circumference* of the liver is irregular in figure and of unequal thickness; and all, except its posterior margin, covered by peritonæum. 1. The anterior edge is thin, and has two notches; one deep and narrow, the commencement of the longitudinal fissure, lodging the remains of the umbilical vein, and the duplicature of peritonæum which surrounds it; the other larger, receiving the fundus of the gall-bladder; but not always found. 2. The posterior edge is shorter but thicker, especially to the right. It is attached to the diaphragm by the triangular and lateral ligaments, between which it is destitute of peritonæal covering, about two fingers' breadth, and connected by cellular membrane with the diaphragm. In its middle is an irregular depression which terminates the great fissure, and a fossa which assists in forming a canal for the vena cava inferior, at the bottom of which the hepatic veins terminate.

STRUCTURE OF THE LIVER. Of a peculiar character, consisting principally of numerous vessels, viz. the ramifications of the vena portæ, (a venous system of peculiar structure, distribution, and function;) those of the hepatic artery, of the hepatic veins, and of the excretory ducts: to all which, add the numerous branches of nerves and absorbent vessels distributed to it.

It derives its principal covering from the peritonæum, which is continued on to this viscus from different surrounding parts. It leaves different parts uncovered; viz. the posterior edge, the two fissures, the depression for the vena cava, and that for the gall-bladder. Beneath this is condensed cellular membrane.

VENA PORTÆ. This consists of two orders of vessels, which

communicate by a common trunk: the one formed of the veins which return the blood from the chylopoietic viscera, from the spleen, pancreas, stomach, and intestines, called the *vena portæ abdominalis;* the other, called the *vena portæ hepatica,* consisting of the ramifications of the trunk in the substance of the liver, to which they are distributed like arteries. The trunk of the vena portæ abdominalis is formed more immediately by the splenic and superior mesenteric veins. It passes upwards and to the right from the vertebral column to the porta, being about four or five inches in length: is at first placed behind the right extremity of the pancreas and duodenum, afterwards within Glisson's capsule. At the porta it bifurcates, the branches forming a canal lying horizontally in the porta, each making nearly a right angle with the trunk. Of these branches, the right, which is the shorter, but larger of the two, passes to the right lobe, and ramifies in its substance. The other (the lesser, but longer) is continued to the left as far as the great fissure, unites with the ligamentous remains of the umbilical vein and ductus venosus, and is distributed to the left lobe. The ramifications of the vena portæ take a horizontal direction. The ultimate divisions of the vena portæ, it has been inferred from injections, anastomose with the radicles of the biliary ducts and hepatic veins. It is found also that minute injections pass into the hepatic arteries, and if thrown into any one order of vessels, find their way into the rest. The branches of the vena portæ are accompanied by those of the hepatic arteries, veins, biliary ducts, and lymphatics; and they are all included and connected by a dense cellular structure. The vena portæ, like the rest of the abdominal veins, differs from the general venous structure by the greater thickness of its coats and the absence of valves.

HEPATIC ARTERY. Is a branch of the cœliac, subdividing into two principal branches; these pass into either lobe at the porta, again subdivide, and are continued with the ramifications of the vena portæ.

HEPATIC VEINS. Take their origin from all parts of the substance of the liver by capillary extremities, which communicate with the hepatic arteries and vena portæ. They unite into larger and less numerous branches, and terminate by three or four principal trunks in the vena cava inferior behind the liver. There are also some few smaller branches.

BILIARY DUCTS. Arise by minute extremities, from all parts of the substance of the liver. Their ramifications accompany the nerves and vessels. In making a section of the liver their orifices may be distinguished by the yellow fluid which exudes. These have been called *pori biliarii.* They gradually unite into larger branches and form trunks, which are all brought together in the ductus hepaticus, which is found in Glisson's capsule.

SUBSTANCE OF THE LIVER. Tender, and may be broken down by pressure with the finger, without injury even to the peritonæal covering. Even abstracting the vessels above described, which, with their various ramifications, constitute so large a portion of the whole mass, there appears to be a structure peculiar to the *substance* of the liver, *as* such. If a section be made of the viscus, it presents a smooth surface, composed of small points of a reddish brown and pale yellow intermixed. The orifices also of the vessels distributed through its substance become perceptible in the manner already noticed. If a portion of the liver be torn away or broken off, the surfaces will appear rough, granulated, and made up of small irregularly rounded grains or bodies, of a reddish brown colour and soft consistence. These have been called *acini,* and if we take thin sections or slices, injected minutely and dried, minute vessels are seen to radiate from them, and are thence named *penicilli.* These grains are united, as well as the vessels, by a cellular texture.

GALL-BLADDER, *Vesicula Fellis*. It is a membranous bag of a pyriform shape; situated under the right lobe in a superficial cavity, as already noticed. Superiorly, it is connected to the substance of the liver; below it presents a surface more considerable than the former, and covered by peritonæum. This is contiguous to the pyloric extremity of the stomach, to the duodenum, and the right extremity of the arch of the colon; all of which parts are tinged, in the dead body, of a yellow colour, from the transudation of the bile. It is divided into *body*, *fundus*, and *cervix*. In the erect posture, its fundus or base is situated anteriorly, inferiorly, and to the right; its cervix, posteriorly, superiorly, and to the left. The base is covered more or less by peritonæum; it answers to a notch in the liver, and is more or less visible according to its state of distension. The cervix is bent so as to form a convexity above and a concavity below, and terminates in the *Ductus Cysticus*. This is about the same length as the *Hepatic Duct*, with which it unites below, so as to form the *Ductus Communis Choledochus*.

The gall-bladder is found, by dissection, to be composed of two coats:—1. An external, or *peritonæal*, which is partial, belonging only to the under surface and base, passing off from the circumference of the cavity in which the gall-bladder is placed, and covering rather more than half. Under this coat there is a quantity of dense cellular membrane, forming numerous dense filaments, which take the length of the bladder, and have by some anatomists been described as a muscular coat. 2. An internal, or *mucous*, of some thickness, and of a white colour, but after death becoming yellow from the transudation of the bile. It has a villous appearance; and is disposed in numerous rugæ, which have a reticular distribution. It has numerous follicles for the discharge of a protecting and lubricating mucus.

DUCTUS COMMUNIS CHOLEDOCHUS. By the union of the cystic and hepatic ducts at an acute angle, the ductus communis choledochus is formed, appearing, indeed, as a continuation of the latter. It passes before the vena portæ in Glisson's capsule, gains the posterior part of the right extremity of the pancreas, passes behind the second portion of the duodenum, here sometimes joining with the duct of the pancreas, but more commonly passing with it through the muscular coat. The two ducts then accompany each other obliquely between that and the villous coat of the duodenum; and then terminate, by a common orifice, behind the second curve of the duodenum.

Structure of the Ducts. The ducts of the liver and gall-bladder, and the common bile duct, are composed of two tunics; an external, which partakes of the nature of the cellular texture, but extremely dense, and composed chiefly of whitish longitudinal fibres. The second is a mucous membrane, villous, and in some degree reticulated like that of the gall-bladder. At the beginning of the ductus cysticus it forms numerous folds, or partitions, so as to render the passage tortuous. They are generally found tinged by the transudation of the bile.

The Spleen and Pancreas are now to be removed with the Duodenum, in order to examine their structure.

§ 5. OF THE SPLEEN.

The Spleen is of a purple, or livid colour, mixed commonly with patches of a bright red, or black; of an oval figure, but subject to variations, and sometimes more or less triangular or square. The size varies, differing considerably in different individuals; and, though in the ordinary use of words there is but one proper spleen, it is not uncommon to find in the great omentum one, two, or more small bodies, of the same apparent structure.

It is divided into two surfaces, an external and an internal, and a circumference.

The *external surface* is convex, contiguous to the diaphragm, (often indeed united to it by preternatural adhesions.) It corresponds to the four last ribs on the left side. The *internal surface* is divided lengthwise into two parts, by a depression, which has been called the fissure of the spleen; in it there is commonly some fat, and at this part the vessels and nerves enter. It is slightly concave, and is contiguous to the left extremity of the stomach above, and to the kidney below. The *circumference* of the spleen is irregular, being commonly thicker above and behind than in the opposite directions. The edge is sometimes regular and smooth, but is often interrupted by notches indefinite in extent and number.

The *substance* of the spleen is remarkably soft, and yields readily to the finger. It consists principally of a congeries of blood-vessels, in addition to lymphatics, nerves, and cellular membrane; but these forming a peculiar structure. It is invested by a continuation of the peritonæum, which covers it entirely, except at the fissure; but here it passes off, being continued with that fold of the peritonæum which fixes the spleen to the diaphragm; with that part of the same which goes to the stomach; and with the greater omentum. Between these are the splenic vessels.

The *arteries* of the spleen are branches of the splenic artery; which is itself one of three into which the cœliac divides. It takes it course along the edge of the pancreas; at the left extremity of which it divides into five or six branches that penetrate the substance of the spleen at the fissure. These branches again subdivide and ramify so numerously that the spleen appears a mere vascular congeries.

The *veins* are collected into five or six trunks, forming the splenic vein by which the blood is returned to the vena portæ. They are larger than the arteries.

The *intimate structure* has not been clearly explained. If a healthy spleen be cut through, its texture readily yields. The cut surfaces present a spongy appearance, intermixed with small granular bodies varying in size and of a greyish colour. These have been called the *acini* of the spleen. After maceration, when the cellular texture of the spleen has been in a great measure destroyed, the ramifications of the splenic artery are seen to terminate in these little bodies, which on minute injection seem to be a congeries of vessels. If the cut surface of the spleen be scraped, there exudes a quantity of livid half-coagulated blood, supposed by some to have remained in the capillary vessels of the spleen, whilst other anatomists conceive that it had been deposited in a cellular structure interposed between the arteries and veins, as in the placenta and corpus cavernosum of the penis. That the spleen consists in a great measure of a cellular texture may be seen when the blood is evacuated by repeated washing, or by inflating and partly drying it; it will be then found to be made up of a network of firm fibres, crossing each other in all directions. The connection of this structure with the blood-vessels may be demonstrated by blowing air either through the arteries or through the veins; for in so doing the whole spleen becomes inflated. The communication is much freer with the veins, however, than with the arteries, for even a coarse injection will find its way from the veins, but no injection will pass from the arteries without rupture.

§ 6. OF THE PANCREAS.

The pancreas is a conglomerate gland of a yellowish colour, long and narrow, and flattened both anteriorly and posteriorly. It is divided into two extremities; two surfaces, an anterior and a posterior; and two edges, a superior and an inferior. The *superior edge* is thicker than the *inferior;* and upon it is a depression which lodges the splenic artery. The *right extremity,* called sometimes the head of the pancreas, is larger than the left, and adheres to the second curve of the duodenum. From this extremity there generally extends along the duodenum a process called the *Lesser Pancreas.* The *left extremity* is connected with the spleen. In *structure* it

resembles the salivary glands, being of a firm consistence, and composed of lobes, and these again of smaller lobes, or *lobuli*, connected by a firm cellular structure. The pancreas has no other external covering than the peritonæum, which covers it superiorly and anteriorly.

Its *excretory duct* is membranous, white, and of inconsiderable thickness. It arises by minute radicles, which unite and form a single canal about the size of a small quill, but which gradually becomes larger as it approaches the duodenum. It passes through the middle of the gland, and may be displayed by a longitudinal incision of the gland; it is situated nearer to the anterior surface, and its course is not perfectly straight. It receives in its passage collateral branches, and before its termination a canal of less size from the Lesser Pancreas. It then penetrates obliquely from above to below the coats of the duodenum, and usually terminates at one common orifice with the ductus communis choledochus, at the lower part of the second curve of the duodenum.

§ 7. OF THE URINARY ORGANS.

The dissection of these organs may be commenced by examining the situation of the kidneys, and of the vessels connected with them and the organs of generation.

Kidneys. Are of a pale red colour, and are situated deep in the lumbar region. They are placed one on each side of the spine, extending downwards from a point nearly opposite the eleventh rib, and connected with the diaphragm, and the psoas, quadratus, and transversalis muscles. They are embedded here in a considerable quantity of fat contained in a loose cellular texture, which has been sometimes called the *Tunica Adiposa.* The right kidney, lying behind the colon, is somewhat lower than the left, being placed immediately below the large lobe of the liver, which occupies more space than the spleen fills on the opposite side. The left kidney is placed below and behind the spleen, and posteriorly likewise to the left portions of the stomach, pancreas, and colon.

Through the abdomen along the spine inclined to the left side of the lumbar vertebræ the *aorta* is seen taking its course: on the right side of the aorta is the *vena cava inferior*, in which the *right spermatic vein* terminates, whilst the *left* empties itself into the left emulgent vein: on each side of the aorta, and nearly midway between the superior and inferior mesenteric arteries, arise the *spermatic arteries.* These descend over the psoæ muscles. In the male they are then continued to the spermatic cord to be distributed to the testicle: in the female pass between the layers of the ligamenta lata to be dispersed upon the ovaria and fundus of the uterus.

The arteries of the kidneys are called *emulgent*, or *renal.* They are derived from the aorta, passing off at nearly right angles; are commonly two in number, and of considerable size; but frequently more, and of smaller size. The right is longer than the left on account of the position of the aorta, and commonly passes behind the vena cava; but they both pass outwards and a little downwards, and as they approach the kidney divide into branches, which pass in at the sinus. The *emulgent veins* are larger than the arteries, forming a large trunk on each side which lies anterior to the corresponding artery, and runs transversely to the vena cava; the left, which is the longer of the two, passes across the fore part of the aorta.

The *ureters* or excretory ducts of the kidney are about the size of a quill. At their origin they are situated behind the emulgent vein; they then descend obliquely inwards behind the peritonæum, upon the psoæ muscles, are continued into the pelvis, and terminate, as will be seen hereafter, at the under, outer, and back part of the bladder. See page 271.

The kidney and *capsula renalis* may now be taken out in order to examine their structure.

KIDNEY. Like the figure of the bean so called, is elongated from above to below, its outer margin convex, and its inner concave, having a depression or *sinus* at which the vessels enter; and its upper extremity is broader and more curved above than the inferior. It is covered only anteriorly by the peritonæum, which is loosely connected with it by cellular membrane. But it has a proper covering, *tunica propria,* which closely invests the whole exterior of the gland, and passes in with the vessels at the sinus. It forms a thin layer, and appears composed of condensed cellular membrane.

The substance of the kidney is firm in its consistence. It is formed of two distinct kinds of structure—the *cortical,* and the *tubular* or medullary. The *cortical* forms the exterior of the gland, being disposed in a layer of about a quarter of an inch in thickness; besides which it sends in partitions, *columnæ,* vel *septa,* which divide the portions of medullary substance, diminishing in thickness as they extend towards the pelvis of the kidney. This part of the kidney is less firm and more easily torn than the medullary. It is of a yellowish or brownish red, and principally composed of vessels. It is in this part of the kidney that the branches of the emulgent artery minutely ramify, terminate on the one hand in

the extremities of the veins, and on the other furnish the secretion of the urine from their own minute extremities; for which cause the cortical has been called the *secerning* part of the kidney.

The *tubular* or medullary substance is denser, or firmer in its consistence, and is distinguished by its reddish white colour. It is formed of several conical bodies of different size, whose bases are placed towards the exterior, and their apices towards the pelvis of the kidney, surrounded, except at the points, by the cortical substance. These bodies have a striated appearance, being composed of the ducts, *tubuli uriniferi*, which convey the urine after its secretion in the cortical part, and pass from the base to the point, where they terminate by open mouths from which the urine may be expressed. The points of the cones just described project, and are called the *papillæ*, vel *processus mammillares*. These vary somewhat in figure; and also like the medullary cones, in number, being found from eight to eighteen; but often one cone has two mammillary processes, or two cones unite in one larger process.

The points at which the uriniferous tubes begin, and where secretion takes place, are supposed to be small corpuscules, or *acini*, which become distinct when the kidney has been minutely injected. Towards these the minute ramifications of the artery pass in a tortuous course.

The papillæ are surrounded by membranous tubes called *infundibula*, vel *calices*, and the points of the papillæ project within them. They are sometimes the same in number with the papillæ, but frequently vary in consequence of two or more opening into the same infundibulum. They are of different lengths, and commonly join into two or three larger trunks, which terminate in a membranous cavity of some size, called the *pelvis*. It is of a conical form, situated in the sinus of the kidney, appearing partly within and partly without its body, and at a little distance from the sinus it contracts and forms the *ureter*. The pelvis is occasionally double.

The structure of the ureter, pelvis, and infundibula, is similar in each, consisting, exteriorly, of a membranous covering, which does not appear to differ from condensed cellular membrane, and internally of a mucous coat; but which is indistinct. A third or muscular coat has been described as belonging to the ureter, but its existence is doubtful.

Capsulæ Renales. *Capsulæ Atrabiliariæ*, *Renes succenturiati*, *Glandulæ supra-renales*. Are two small bodies situated one on each kidney, at the upper and inner part, and surmounting it like the comb of a cock. They vary in figure, are flattened, sometimes oval, more commonly like a wedge, broad below, and hollowed in adaptation to the kidney, and edged above. They are larger in the fœtus than in the adult. They are usually of a dark yellow colour, covered anteriorly by peritonæum; and, besides their connection to the kidney, are attached to the diaphragm, the right to the liver, the left to the spleen and pancreas.

Their surface is furrowed, so as to have the appearance of a conglomerate gland; and, within, they have a cavity, between the anterior and posterior parietes, which may be inflated, and contains a yellowish brown or bloody coloured fluid; but these circumstances are not always distinctly noticeable.

§ 8. OF THE DIAPHRAGM.

DIAPHRAGM. *Septum Transversum.*

Situation. Forms a broad thin muscular partition between the cavities of the thorax and abdomen. It is broad at the sides and narrow in the middle; is concave below and convex above; and is considerably higher before than behind, so that the cavity of the chest reaches down posteriorly behind the upper part of the cavity of the abdomen. It is usually divided into a superior or greater muscle, and an inferior or less muscle.

a. SUPERIOR OR GREATER MUSCLE OF THE DIAPHRAGM.

Origin. By fleshy slips from the cartilago ensiformis and from the cartilages of the seventh and all the inferior ribs. From these attachments the fibres radiate from the circumference towards the centre.

Insertion. Into the middle or cordiform tendon. This tendon in shape somewhat resembles a trefoil leaf, and is formed by tendinous fibres running in different directions, and interwoven with each other. On the right side of the tendon is a rounded triangular *opening* for the passage of the vena cava inferior from the abdomen into the chest.

b. INFERIOR OR LESS MUSCLE OF THE DIAPHRAGM. Called also the Appendix. Is situated on the lumbar vertebræ.

Origin. By four heads from the three uppermost lumbar vertebræ, of which the fleshy bellies form the *crura* of the

Would it not be better to cut first

The Diaphragm

Arises by fleshy slips from the cart [illegible] of the lower six pairs of ribs near their cartilages [illegible], and by two crura from the three upper lumbar ver[illegible] by four tendinous slips forming — All the [illegible] run upwards and inwards towards a common tendon into which they are inserted. The crura in their course leave an [illegible] the aorta between them, & by the interlacing of their fibres forming a second hole for the oesophagus

diaphragm. These unite, are continued upwards, and spread in their ascent. The inner and longer crura leave between them a long OVAL OPENING, *hiatus aorticus*, through which the aorta passes from the thorax into the abdomen. Above this opening the fasciculi of the crura on each side decussate in part, and again separate to form an OVAL APERTURE, *foramen œsophageum*, which is situated rather to the left, and through which the œsophagus is continued from the thorax into the abdomen.

Insertion. Fleshy into the cordiform or middle tendon.

The diaphragm is sometimes partially defective, so as to leave an opening through which some of the contents of the abdomen may be protruded, and form a hernia of the diaphragm.

Use. It is the principal agent in inspiration, by its descent enlarging the cavity of the chest; it presses down the abdominal viscera and assists in the expulsion of the fæces and urine and in vomiting.

CHAPTER III.

Of the Organs of Generation in the Male.

§ 1. OF THE PARTS EXTERIOR TO THE PELVIS.

Scrotum. Contains the testicles. It is formed by a continuation of the common integuments. A line, termed *raphe,* extending from the under part of the penis longitudinally backwards over the middle of its surface, to the perineum, divides it into two equal parts. Beneath the skin a muscle has been described by some anatomists, called *Dartos.*

The inner surface of the scrotum is lined with reticular membrane, which serves to connect it with the covering of the testicles. It is long and loose in its structure, so as to allow of free and considerable motion. Opposite to the raphe it is condensed, so as to form a *septum* between the sides of the scrotum and the testicles.

Tunica Vaginalis. Is a serous membrane which gives a double covering to the testicle, having the loose cellular membrane of the scrotum attached to its exterior. Originally produced by the peritonæum, it subsequently forms a shut sack, or circumscribed cavity, which is disposed with respect to the testicle as the pericardium is with respect to the heart, a disposition which it has in common with other reflected membranes; it gives the testicle a close covering, and is then reflected, so as to give it a second or loose covering. In its structure it resembles the peritonæum, externally cellular, and connected with the adjacent parts; internally smooth and unconnected, and its surface lubricated by a secretion, which preserves the mobility of the parts, and protects the testicle from pressure.

On cutting open the reflected portion the position of the testicle is seen. It is placed obliquely, the upper part projecting forwards, and the part called the epididymis at the outer and back part. The left testicle is situated lower than

the right. They are attached to the spermatic cords, which are connected with them at the lower and back part.

Spermatic Cord. Consists of the vessels and nerves of the testicle, which pass through the inguinal canal, already described, see page 234. and having made its appearance at the external abdominal ring, it is continued down to the testicle. In dissecting the Spermatic Cord it will be found to be invested with

Three Coverings; of these,

The *exterior* is derived from the *aponeurosis of the external oblique muscle*, which is continued round it, into the scrotum; it is distinct, and becomes thickened in old herniæ.

The *second* consists of the *cremaster muscle*, which is made up of a number of pale fibres, deriving their origin from the lower edges of the internal oblique and transversalis muscles of the abdomen; it surrounds the spermatic vessels and passes with them through the external abdominal ring as far as the testicle, where the fibres spread upon the tunica vaginalis.

The *third* covering is called the *tunica vaginalis of the cord;* it is a continuation of the peritonæum which passes down through the inguinal canal, and having given this covering to the cord, is continued over the testicle to form the tunica vaginalis testis; in both, the tunic is double, consisting of a close and reflected portion; but in this of the cord the two portions are commonly not distinct, from its cavity having been obliterated in the completion of the healthy processes, and thus confounded with the common cellular membrane. In some persons, however, it is distinct and not closed.

The Vessels consist of

The *spermatic artery*, which is a branch of the aorta.

The *spermatic veins* are larger and more numerous than the arteries. They pass upwards in the spermatic cord, forming a plexus, which has been called the *plexus pampiniformis*, vel *pyramidalis*.

The *vas deferens*, the excretory duct of the testicle, begins from the lower part of the epididymis. It is at first serpentine, becomes then straight, and passes up with the vessels of the cord and through the inguinal canal. It is of a whitish colour; its parietes are firmer and thicker than those of any other excretory duct, so as, when put between the finger and thumb, to appear like whip-cord. There is only one tunic distinct, which in some parts has nearly the consistence of cartilage. It is probably lined by a mucous membrane.

Besides these, a small artery derived from the internal iliac accompanying the vas deferens, and a branch of the epigastric artery distributed to the cremaster muscle, are found in the cord, together with

The NERVES, which are the *Spermatic Plexus.*

OF THE TESTICLE.

The testicle is of an ovoid form, flattened at the sides. It varies somewhat in size in different individuals; is plump and large in youth, but becomes small and flaccid in age. Not unfrequently one testicle is larger than the other. It appears of a whitish colour, owing to its exterior covering.

The situation of the *epididymis* at the outer and back part of the testicle has been already noticed. It is enclosed in the same covering of tunica vaginalis. It is of a lengthened form, adapted by its bend to the surface of the testicle; it is larger at the extremities, more especially at the upper extremity, than in the middle, where it is flattened. The upper extremity is called the *globus major,* or head; the lower, the *globus minor* or *cauda.* It is attached to the tunica albuginea of the testicle generally by one of its edges, and by the head and the cauda, particularly by the latter, which has a firm connection; the tunica vaginalis dips in between, covering only those parts not attached to the testicle, and forms two little pouches between the testicle and the epididymis, which at the under part is turned backwards to form the vas deferens.

TUNICA ALBUGINEA. Is the proper covering of the testicle. It has been confounded with the tunica vaginalis, but differs entirely from that membrane in structure. With some care the tunica vaginalis may be dissected in portions from the albuginea, especially at the parts where it begins to be reflected, the connection being less intimate there than at other parts. It is whitish in colour, so as to give that appearance to the testicle when shining through the tunica vaginalis; it is of moderate thickness, but extremely firm, so as to give support and protection to the delicate structure of the testicle. It appears composed of fine dense, white, shining, tendinous-like fibres, intimately interwoven with each other without regular arrangement. The internal surface is rough and cellular, and a number of filaments pass from it through the substance of the testicle, extending from

behind to before in a radiated manner, forming *septulæ*, or partitions, between which the blood-vessels and seminiferous tubes are disposed.

Substance of the Testicle. It consists of the excretory ducts of the testicle, together with blood-vessels, lymphatics, and nerves. On cutting open the tunica albuginea the testicle appears of a yellowish colour and pulpy consistence. It is made up of the *tubuli seminiferi*, minute ducts, which begin from the extremities of the secreting arteries, and are for the conveyance of the semen. These ducts are extremely numerous, are very minute, and are coiled up between the septulæ in the form of lobes, which are above twenty in number. At the upper and back part of the testicle, opposite to the attachment of the epididymis, the tubuli are collected together; they communicate and form fewer and larger trunks; constituting at this part an irregular network, which has been called the *rete testis*, and intermixed with a good deal of cellular membrane. From the rete more than twenty ducts, called *vasa efferentia*, pass to the upper part of the epididymis; in the upper part or head of that body they become much convoluted, in the shape of cones called *coni vasculosi*. The vessels forming the coni unite in a single duct, which by its numerous turns connected by a firm cellular substance forms the rest of the *epididymis*. The duct increases in size as it descends, below it is reflected upwards from the extremity of the epididymis, and ascends with the turns unfolded, but still distinct, and terminates by forming the *vas deferens*, the course of which has been already described.

OF THE PENIS.

The penis is more or less of a cylindrical figure. The part by which it is attached is called the *root;* the opposite extremity, by which it terminates, is formed by the *glans;* the intervening part is named the *body*. It is covered by the common integuments, continued from the scrotum and pubes. At the under part is a projecting line called *raphe*, which runs along the penis, and is continuous with that of the scrotum. At its extremity the skin forms a covering to the glans, called the *prepuce;* which is attached at the under part of the glans, near the opening of the urethra, by a fold, called the *frænum;* this is in general so long, as to allow of the complete denudation of the glans. Near the *corona glandis*, or circumference of the glans, are situated numerous mucous follicles, especially near to the frænum; they are called *glan-*

dulæ odoriferæ from the strong and peculiar odour of the secretion, which is an oily mucus for the lubrication of these parts.

The penis is composed of three portions, two of which form the upper part and sides of the body, called *corpora cavernosa;* the third is situated below, and is named *corpus spongiosum.*

The Corpora Cavernosa appear, when distended, like two equal, but irregular, cylinders, closely applied and joined to each other. At the posterior extremity they separate on each side, at the under part of the symphysis pubis, into a blind conical extremity, somewhat more than an inch in length, called *crura,* by which the penis is fixed, they being attached to the inner part of the rami of the ossa ischia and ossa pubis.—They terminate anteriorly in a rounded extremity, to which the glans is attached. They have a groove above, which lodges the principal vein of the penis, and a considerable depression runs along the penis between them below, for receiving the corpus spongiosum urethræ. They are connected above to the symphysis pubis by a broad triangular production, called the *ligamentum suspensorium;* but which appears rather to be of the nature of condensed cellular membrane.

The corpora cavernosa are separated lengthwise by a partition, or *septum,* attached by its upper and under edges to the sheath, and appearing to have the same structure. This *septum* begins at the junction of the crura, but is not continued distinctly to the extremity of the penis. The greater part is composed of parallel and vertical cords, between which are openings, which allow of a ready transmission of *fluids* from one of the corpora cavernosa to the other. It has been also called the *pecten.*

The corpora cavernosa have each an exterior elastic covering, or sheath, of ligamentous structure, which has numerous perforations for the passage of blood-vessels. The substance of the corpora cavernosa is composed of filaments and plates of cellular membrane, forming the whole into an intricate and irregular network. This is seen after the blood, of which always a considerable quantity remains, has been removed by maceration.

The Corpus Spongiosum (or Corp. Spong. Urethræ, from its lodging and surrounding the urethra) is situated under and between the corpora cavernosa. It projects behind the junction of the corpora cavernosa, its posterior extremity dilating into a conical rounded projection, called the bulb, *bulbus urethræ.* This is placed between the crura, and extends from the root of the penis to near the anus, connected to the surrounding parts by a dense cellular substance, and attached posteriorly to a ligamentous expan-

sion. It projects most at the under and back part. The corpus spongiosum is contracted where it joins with the corpora cavernosa, then extends along beneath them, and at their extremity is a second time expanded into the body called the *glans penis.* The glans is of a conical form, having a base or broad part and an apex or tip. The base has an oblique direction, so that the glans is about twice as long above as below. It covers and encloses the ends of the corpora cavernosa, from which it is separated by a continuation of their ligamentous covering. The base is encircled by a prominent margin, most distinct posteriorly, and called *corona glandis*, behind which is a contraction, often called the *cervix:* at this part are situated the glandulæ odoriferæ. The glans is covered by a continuation of the common integuments, which here, however, are extremely thin and delicate.

The corpus spongiosum has an exterior covering which resembles that of the corpora cavernosa, but is less dense and strong. Its internal structure also resembles in appearance that of the corpora cavernosa; but some anatomists have considered it to be a congeries of veins.

§ 2. OF THE PERINEUM.

In order to perform the dissection conveniently, it is necessary to fix the subject in the same position as that for the operation of lithotomy. The integuments are first to be carefully raised in that part of the perineum before the anus, which is bounded laterally by the rami of the ischia and pubes. A layer of *aponeurosis*, more or less distinct, will come into view, of the same kind as has been already described.—In tracing its extent it will be found attached to the rami of the pubes and ischia; and if a blow-pipe be inserted under it, the air thrown in will insinuate itself through the cellular membrane of the scrotum as far as the groins, showing its connection with the aponeurosis of the external oblique.

Remove this aponeurosis and the fat and cellular membrane connected with it, and in the middle will be seen the bulb of the penis, with the corpora cavernosa attached one on each side to the tuberosity and crus of the ischium—these are covered by, and connected with, the muscles of the

GENITAL REGION, consisting of four pairs.

1. M. ERECTOR PENIS.

Situation. Described by its origin.

Origin. Tendinous from the inner side of the tuberosity of the ischium; runs upwards, fleshy, surrounding the whole of the crus of the penis.

Insertion. Tendinous into the ligamentous sheath of the corpora cavernosa, as far as their junction.

Use. To compress the crus penis, and to give the penis its proper direction.

2. M. ACCELERATOR URINÆ.

Situation. Covering the bulb of the penis.

Origin. Fleshy from the sphincter ani, by means of interposed cellular substance, and from the membranous part of the urethra; and tendinous from the crus and from the beginning of the corpus cavernosum. It forms a thin layer, the inferior fibres of which run more transversely than the superior.

Insertion. Into its fellow by a tendinous line which runs along the middle of the bulb; so that the two muscles together completely enclose the bulb.

Use. To eject the semen or urine by spasmodic contractions.

3. M. TRANSVERSUS PERINEI.

Situation. Between the tuberosity of the ischium and the accelerator urinæ.

Origin. From the tough membranous substance on the inside of the tuberosity of the ischium; runs transversely inwards.

Insertion. By means of condensed cellular substance into the accelerator urinæ and sphincter ani.

Use. To dilate the bulb and to draw the perineum and verge of the anus a little outwards and backwards.

4. M. TRANSVERSUS PERINEI ALTER.

Situation. Before the former.

Origin. From the inside of the ischium immediately before the tuberosity.

Insertion. Into that part of the accelerator urinæ which covers the anterior part of the bulb.

Use. To assist the former muscle.

Continue the dissection backwards, bounding the space by the lower edges of the glutæi maximi muscles, where they pass from the os coccygis over the tuberosities of the ischia. In the middle will be seen the rectum, which, when the fat between it and the tuberosities of the ischia has been removed, appears to protrude like a funnel, and round it is the

ANAL REGION, containing two muscles.

1. M. SPHINCTER ANI.

Situation. Around the verge of the anus.

Origin. From the extremity of the os coccygis; it runs forwards in two columns near the verge of the anus, so as to

form an oval muscle, which surrounds the extremity of the rectum.

Insertion. By a narrow termination into a condensed cellular substance, which connects it with the acceleratores urinæ and transversi perinei.

Use. To close the anus.

2. M. Levator Ani.

Situation. Surrounding the rectum like a funnel.

This muscle should be laid bare, but it cannot be completely dissected till the os innominatum has been separated. In continuing the dissection, a thin *ligamentous expansion* will be found deep-seated between the pubes and ischia, stretched between the rami of the pubes, of a triangular form, to which the bulb is firmly connected, and through the centre of which the urethra passes.

Origin. By a distinct edge from the os pubis within the pelvis, at the upper edge of the foramen obturator; from the aponeurosis covering the obturator internus and coccygeus muscles; and from the spinous process of the ischium. Its fibres descend and converge.

Insertion. By intervening cellular substance into the sphincter ani and acceleratores urinæ, and into the extremity of the os coccygis. The two muscles form together a kind of funnel, which surrounds the extremity of the rectum, neck of the bladder, prostate gland, and part of the vesiculæ seminales.

Use. To raise the rectum after it has been depressed in passing the fæces.

§ 3. OF THE SIDE VIEW OF THE CONTENTS OF THE PELVIS.

We have brought this part of the dissection under a distinct title in order to convey a more accurate knowledge of the relative position of these parts.

The side view of the contents of the pelvis may be prepared by separating the left os innominatum at the sacro-iliac symphysis, cutting through the symphysis pubis without injuring the urethra below, then turning the viscera to the right side, distending the bladder, and stuffing the rectum. The accuracy of the impression will, however, much depend upon bearing in mind the changes producible by changing the position of the pelvis. It has been already observed, that in the erect posture of the body, and likewise in the horizontal, if the lumbar vertebræ be not incurvated, the axis of the pelvis will form an acute angle with that of the trunk. But in proportion to the raising of the pelvis, or to the incurvation of the lumbar vertebræ, the angle will become less and less, till at length the axis of both will coincide.

The position of the bulb of the corpus spongiosum, with respect to the adjacent parts, will now be better seen. Situated between the diverging rami of the ossa pubis and below their symphysis. It is here fixed in its position by its connection with the triangular layer of condensed cellular, or ligamentous-like substance, called *Ligamentum Triangulare Pubis,* attached to the rami, and reaching up to the symphysis pubis. This also sends processes backwards to the prostate and to the bladder, which fix and connect these parts, as well as the membranous portion of the urethra, by the side of which they run. Immediately behind this, and behind the lower part of the symphysis pubis, is placed the

PROSTATE GLAND, which surrounds the neck of the bladder, is connected to the pubes and adjacent parts by a quantity of tough cellular substance, and lies upon the fore part of the rectum. It may be felt by passing the finger up the rectum, from an inch to an inch and a half above the verge of the anus; and it is in this way that morbid alterations in its size are ascertained. The *M. compressor prostatæ,* depicted by Albinus and Soemmering, is a slip of muscle which begins tendinous from the os pubis between the lower part of the symphysis, and the upper part of the foramen, passes backwards in the form of a thin, narrow, fleshy slip, around the prostate, and is lost in, or joins with, the opposite *compressor,* between the prostate and the rectum.

Mr. Wilson has described also two *muscles* at this part, which deserve especial notice. They arise by separate tendinous attachments from the inside of the symphysis pubis, they descend, fleshy; separate, to enclose the membranous part of the urethra; spread themselves on its side through its whole extent, so as to form two broad triangular muscles; then fold themselves under it, and are united at a middle tendinous line, by which these muscles are both connected at one extremity, with the acceleratores urinæ, sphincter ani, and transversi perinei. These muscles contract the membranous part of the urethra, and draw it against the symphysis.

Between the bulb and the prostate is seen the

MEMBRANOUS PORTION OF THE URETHRA. This is scarcely an inch in length; at its passage from the bulb it is not situated immediately under the symphysis, for there intervenes a strong transverse ligament. Here it passes

through the dense triangular cellular substance before described; and then curves upwards to enter the prostate. It is to be remarked, that, during its course, but especially at the commencement, it is fixed in its position. Behind the os pubis is situated the

BLADDER; its upper and rounded part, or *fundus*, is placed somewhat anteriorly. The lower and posterior part, or *base*, formed into a capacious pouch, is received into the hollow of the rectum; the lower and anterior, which is also the most depending part of the bladder, and narrow and funnel-shaped, is called the neck, or *cervix*, and is connected with the prostate. The bladder is connected to the rectum, pubes, and surrounding parts by firm cellular membrane. When empty, its fundus does not rise above the level of the ossa pubis; but when distended with urine, it rises up within the abdomen, and is in contact with the recti muscles: the pouch is larger, and more projecting towards the rectum.

The RECTUM is situated behind; after it has descended into the pelvis, it takes the curve of the sacrum, with which it is firmly connected; but for some way above the anus, its direction is nearly straight, and it is at this part usually dilated into a larger or smaller pouch. In the hollow of the rectum, between it and the bladder, are the

VESICULÆ SEMINALES; pyriform bodies, the narrow anterior parts of which are connected with the prostate gland, and are closely approximated to each other: but they separate as they recede upwards, so that the broad parts are at some distance from each other, and thus include between them a portion of the bladder of a triangular figure.

The VASA DEFERENTIA pass forwards to their inner side, after descending at the back of the bladder.

The URETERS are also seen descending into the pelvis, crossing behind the vesiculæ, and terminating at the under and back part of the bladder, at about an inch distance behind the prostate gland.

REFLEXION OF THE PERITONÆUM. The peritonæum, after lining the lower part of the abdominal muscles, passes from the recti on to the fundus of the bladder; it is connected to the bladder and the recti muscles by loose cellular membrane, so that when the bladder from distension rises up in the abdomen, it carries the peritonæum with it, and leaves the anterior and upper part of the bladder uncovered above the pubes. It is continued then over the fundus on to the sides and posterior surface, which it covers as far as the base of the vesiculæ seminales, and terminates in a convex line, which descends between them. It passes then on to the rectum, forming a pouch between it and the bladder, and covers the fore part, and more or less of the sides, of that gut.

§ 4. OF THE STRUCTURE OF THE CONTENTS OF THE PELVIS.

For the dissection of these parts the penis should be detached, the bladder dissected from the parts with which it is connected, and the ureters and vasa deferentia cut through: the penis and bladder are then to be taken out entire, and the bladder inflated.

Urinary Bladder. *Vesica Urinaria.* Some difference will arise from alterations in its capacity, but when moderately dilated it is of an ovoid figure. The regularity of the figure is not, however, exact, being a little flattened before, more convex behind, and rather wider from side to side, than from before to behind. The inferior and posterior part is the most capacious.

It is anatomically divided into *Fundus*, placed upwards and a little forward; *Base*, below and posteriorly; *Body*, between; *Cervix*, at the under and fore part.

It is connected to the adjacent parts by means of cellular membrane and peritonæum; firmly connected to the ossa pubis by means of a ligamentous expansion, which passes from their arch to each side of the neck of the bladder and prostate gland; attached to the parietes of the abdomen by means of the remains of the umbilical arteries, which pass upwards from the sides of the bladder to the umbilicus; and by the urachus, continued to the same part from the fundus. The Urachus is of a conical form, and of a fibrous structure. These several attachments have been called the ligaments of the bladder, among which is sometimes reckoned the fold which the peritonæum forms on each side where it is reflected from the posterior surface of the bladder.

The bladder is constructed of three proper coats, which are united by interposed cellular membrane.

The exterior, formed by the peritonæum, is called *peritonæal*. It is, as has been explained, partial, covering only the upper and posterior parts, and partially the sides.

The second coat, termed the *muscular*, is composed of distinct fleshy fibres, which are stronger and deeper coloured

than those of the intestines. The external fibres which form the strongest portion of the tunic, run for the most part lengthwise on the bladder. More internally the fibres are shorter, are not placed in planes, but intermixed with each other, and take various oblique directions, so that the bladder may be contracted in every dimension during its evacuation. The fibres behind the prostate are strong and numerous, and have been called the *sphincter vesicæ;* but there seems to be no good reason for this distinction.

The third, or inner, is formed of *mucous membrane:* it is united to the muscular by cellular membrane, which has been called a *nervous coat.* This mucous membrane is thin, presents a smooth surface, and in the healthy condition has a whitish appearance. It is rendered unequal by the projection of the bundles of muscular fibres, so as to form folds when the bladder is empty. Its internal surface is lubricated by mucus secreted, doubtless, from follicles, but which are not distinct.

At the under part of the bladder are situated THREE OPENINGS; of which one is placed anteriorly, the other two posteriorly. The anterior is the beginning of the *urethra,* formed by the neck of the bladder. The two posterior are the openings of the *ureters,* which are found with some difficulty. The ureters near their termination run obliquely forwards for about an inch, between the muscular and mucous coat of the bladder; they terminate upon its inner coat by contracted, and somewhat oval openings, at about half an inch distance from each other, and at the same distance behind the beginning of the urethra. This kind of termination answers the purpose of a valve into the ureter.

PROSTATE GLAND. Is of a rounded figure, about the size of a large chestnut, embraces the neck of the bladder and beginning of the urethra, but so that the greater part by far is situated inferiorly. It has been compared in its figure to that of a heart, as represented on playing-cards. The *base,* or broad part is placed posteriorly, the *apex,* or narrow part is placed anteriorly and inferiorly towards the bulb. The lower surface is convex and projecting, and is divided by a longitudinal middle line, marking the division of the prostate into two *lobes,* which project laterally at the lower and lateral parts of the urethra. The upper surface towards the bladder is more or less concave, but at the middle of the base, between the common seminal ducts and the bladder, is placed a third projection or lobe, particularly distinct in cases of diseased enlargement, and described by Morgagni, and more recently and more particularly Sir E. Home (Phil. Trans. 1806), as a *third lobe* of this gland, to see which it is necessary to cut through the upper part of the gland longitudinally. This natural structure had been confounded with disease, and likewise with a peculiar structure at the neck of the bladder, as described by Mr. C. Bell, (Medico-Chirurg. Trans. vol. ii. p. 171.)

From the orifices of the ureters, projections are frequently seen, one on each side, extending to the prostate, and terminating together at a slight eminence; these have been called by the French, *Trigone de la Vessie;* and the slight eminence distinguished by the name of *Luette*, or *Uvula Vesicæ.* Mr. Bell says, that having dissected up the inner coat of the bladder, we shall find two fleshy columns that run from the orifices of the ureters, unite, and are inserted tendinous into the third lobe of the prostate.

The prostate gland has no proper capsule, but is surrounded with dense cellular membrane. Its substance is of great density and firmness, exceeding in this respect most of the glands of the body. Its texture does not present the appearance of any other glandular structure, being apparently composed of condensed cellular substance.

The *prostate gland* has within numerous small straight *ducts*, running obliquely forwards, which terminate by different orifices at the sides of the caput gallinaginis, afterwards to be shown.

VESICULÆ SEMINALES. Are pyriform membranous cavities. Their situation has been pointed out. Their length is about one inch and a half. They are somewhat flattened with slightly convex surfaces and rounded edges. Their posterior extremities, called their *base*, are broad, and widely separated from each other; their anterior extremities, called *cervix*, are narrow, and placed close to each other. Their surface is irregular, formed of lengthened tortuous eminences, divided by corresponding depressions. When cut through, the vesiculæ appear formed of cells; but these appearances are produced (as becomes evident when they have been unfolded by maceration) by the *convolutions* of a tube, from which project about twelve *appendices*, coiled up and united by dense cellular substance. They vary in size, and the processes differ in number in different persons.

The structure of the vesiculæ seminales consists of an *exterior coat*, which is dense and firm in texture, and although not so thick, resembles the coat of the vas deferens; this being lined by a thin and delicate *membrane*, of a whitish colour, formed into different folds, so as to give to the interior a reticulated appearance, and the surface not smooth.

From each vesicula passes a *duct*, which joins at an acute angle with the vas deferens on the same side. By the junction of the two, a common short canal is formed, which converges towards that of the opposite side, becomes smaller in its course, passes through the prostate beneath the bladder, and terminates at the veru montanum, or caput gallinaginis.

COWPER'S GLANDS. Are two small bodies about the size of peas, of a more or less rounded figure, situated at the back part of the bulb of the corpus spongiosum by the sides of the membranous part of the urethra, covered on each side by the accelerator urinæ. They are of firm consistence, of a reddish colour, and are unequal on the surface, having the appearance of conglomerate glands. From each gland an *excretory duct*, of about half an inch in length, passes obliquely forwards through the parietes of the urethra, and terminates within it. These glands secrete a fluid which is discharged into the urethra, the peculiar properties and functions of which are not understood.

URETHRA. May now be cut open throughout its whole length above. The urethra begins at the neck of the bladder, passes downwards and forwards in a curved direction, first through the prostate, behind the symphysis pubis, and then under; it passes into the corpus spongiosum in the groove formed by the corpora cavernosa; and terminates by a longitudinal orifice formed by two lips at the under and fore part of the glans, from which the fold forming the frænum is continued. The divisions of the urethra are:—the *part* which passes through the corpus spongiosum: the *membranous* portion; and the *prostatic* portion. Its whole length may be stated at about nine inches, seven of which will belong to the first division, and an inch to each of the two latter. Its figure is cylindrical, but the diameter not equal throughout.

The urethra has three *dilatations* and three *contractions*. Its first dilatation is at its origin from the bladder: in its passage through the prostate it becomes smaller, and attains its utmost contraction in the membranous portion. In the bulb it dilates anew, forming the *Sinus Morgagni;* then gradually contracts towards and as far as the glans. In the glans it slightly enlarges again, forms the *Fossa Navicularis*, and again contracts at the orifice.

The urethra consists principally of a *mucous membrane*, which is continuous with the membrane that lines the bladder, and with the skin at the orifice of the urethra. The mucous membrane throughout its larger portion is white; but towards the orifice of a reddish hue. There is frequently an appearance of longitudinal folds, which by some have been, without sufficient evidence, thought muscular. In addition to this, the urethra is formed in its passage by the corpus spongiosum and prostate; and at the membranous part by condensed cellular membrane and muscular fibres.

In the prostate the lining membrane forms the projection, which has been before noticed, called the Veru Montanum, *caput gallinaginis.* This is of a reddish colour, broad behind and narrow before; and here the ducts of the vesiculæ seminales, prostate gland, and vasa deferentia terminate.

On the surface of the membrane where it lines the urethra in the corpus spongiosum, are found the orifices of numerous *lacunæ,* that run obliquely from behind to before, and are variable in their size. Just below the glans are one or two of larger size, *lacunæ magnæ.*

CHAPTER III.

Of the Organs of Generation in the Female.

§ 1. OF THE PARTS EXTERIOR TO THE PELVIS.

The female organs of generation are divided into those parts which are placed externally, and are seen without dissection, and into the internal parts which require dissection for their examination, comprehending the Vagina, the Uterus, and its Appendages.

External Parts. Are bounded, anteriorly, by the projection covered with hair, which is called the *mons veneris.* Below this, and continued backwards, is the *fissura magna,* formed by the most projecting of the external parts, the *labia,* which are thick before where continued with the mons, under which they are joined by an *anterior commissure,* but thinner behind where they are united by a transverse fold of the skin, called the *posterior commissure, frænum,* or *furcula.* The fissure terminates behind at the distance of about an inch from the anus: this short space is called the *perineum,* and there is a slight indication of a *raphe* upon it. On separating the labia, are seen—1. The *Clitoris,* a small body more or less projecting, behind the anterior commissure of the labia, and below the symphysis pubis.—2. The *Nymphæ,* two folds which begin at the clitoris, and separating from each other, are lost upon the internal surfaces of the labia.—3. The *Vestibulum,* a triangular, slightly excavated surface, bounded at the sides by the nymphæ, and above by the clitoris.—4. The *Meatus urinarius,* more properly the *orificium urethræ,* which is about an inch distant from the clitoris.—5. The *Orifice of the vagina,* furnished with the *hymen,* or *carunculæ myrtiformes.*—6. Between this opening and the posterior commissure, a slight transverse depression called the *Fossa Navicularis.*

Clitoris. It is situated between the upper parts of the labia, beyond which it seldom projects, its body rarely exceeding an inch in length, and being little more than the third part of that in thickness. It is fixed to the fore part of the symphysis pubis. It consists of a *body* formed by the junction of *two crura*, or corpora cavernosa, contained in a ligamentous sheath with a septum between them. The crura are upwards of twice the length of the body, and, together with the muscles belonging to them, are attached to the crura of the ossa ischii and ossa pubis. The corpora cavernosa have the same structure as those of the penis in the male, except that the spongy texture is more dense. The clitoris has a *ligamentum suspensorium* by which it is connected with the ossa pubis. It is also provided with a *glans* which is covered by a continuation of the skin. The clitoris differs from the penis of the male in being destitute of corpus spongiosum, and having no perforation in it, corresponding to the urethra, for the passage of the urine. The glans is covered by a continuation of the skin of the labia, which at its inferior extremity forms a semilunar fold termed *præputium clitoridis.* The prepuce is furnished with follicles called *glandulæ odoriferæ* upon its inner surface, and with a small *frænum* which fixes it to the glans.

Meatus Urinarius, or Urethra. Has its *orifice* placed behind and a little below the glans of the clitoris, and between the two nymphæ. It is surrounded by a spongy eminence, which projects at its posterior part, and forms a kind of lip to the orifice, called by some authors the *female Prostate Gland.* The canal itself is somewhat more than an inch in length; slightly curving in its direction behind the symphysis pubis. The orifice is surrounded by several lacunæ, or follicles, of considerable depth, secreting a viscid mucus to lubricate those parts, called often *Cowper's glands.*

Orifice of the Vagina, termed likewise Os Externum Uteri. Is placed immediately under the orifice of the urethra. It is naturally contracted in the virgin state by the membrane called the *hymen*, or the *circulus membranosus:* a membranous process, the common form of which is that of a crescent moon, the broadest part being situated towards the perineum, the opening above, and the horns lost on the sides of the orifice. After its rupture, several small eminences are found in its place: and these are supposed to be the remains of the hymen. They are generally small, firm, rounded vascular bodies, and thence called *carunculæ myrtiformes;* in number varying from five to six.

The blood-vessels and nerves of the external parts are from

the pudic branches. The absorbents pass partly to the inguinal glands, partly to those on the lumbar vertebræ or in the sides of the pelvis.

§ 2. OF THE PERINEUM.

The subject is to be placed in the same position as that for the operation of the stone. The muscles, as in the male, form two regions.

a. Genital, containing three pairs.

1. M. Erector Clitoridis.

Origin. Tendinous from the inner side of the tuberosity of the ischium. It runs upward fleshy, increasing in breadth and embracing the crus.

Insertion. Into the crus and body of the clitoris.

Use. To erect the clitoris.

2. M. Sphincter Vaginæ.

Origin. From the sphincter ani, and near the perineum from the posterior side of the vagina. It passes along the outer end of the vagina, covers the corpus cavernosum, going behind the nymphæ.

Insertion. Into the union of the crura clitoridis.

Use. To constringe the cavity of the vagina.

3. M. Transversus Perinei.

Origin. From the inside of the tuberosity of the ischium, running transversely.

Insertion. Into the upper part of the sphincter ani, and into a tough white substance in the perineum.

Use. To support the perineum.

b. Anal, containing two muscles.

1. M. Sphincter Ani.

Origin. From the extremity of the os coccygis. It runs forward within the skin and fat that cover the verge of the anus, forming in its passage a broad, flat, oval muscle, which surrounds the extremity of the rectum.

Insertion. By a narrow point into the transversi perinei and the tough substance of the perineum.

2. M. Levator Ani.

Origin. By a semicircular edge from the os pubis within the pelvis, at the upper edge of the foramen thyroideum; from the aponeurosis which covers the obturator internus and coccygeus; and from the spinous process of the os ischium. Its fibres descend like rays from a circumference to meet those of its fellow, and form with it a kind of funnel.

Insertion. After embracing the inferior part of the vagina and rectum, into the perineum, sphincter ani, extremity of the vagina and in the rectum.

Use. Same as in the male.

§ 3. OF THE CONTENTS OF THE PELVIS AND SIDE VIEW.

INTERNAL PARTS OF GENERATION. Are the Vagina, Uterus, and its Appendages, consisting of the two OVARIA, the two FALLOPIAN TUBES, the two ROUND and the two BROAD LIGAMENTS.

The Uterus is placed in the middle of the pelvis, between the bladder and rectum: it is continuous with the upper termination of the vagina. The Appendages are situated at the sides. Two extensive doublings of peritonæum called the *broad ligaments* fix the uterus to the lateral parts of the parietes of the pelvis; forming, together with the uterus and upper part of the vagina, a transverse partition that divides the cavity into two nearly equal parts, in the anterior of which the bladder is situated, in the posterior the rectum. These ligaments are continuous with the peritonæal covering of the uterus, with the peritonæal lining of the pelvis, and their edge is on a level with the base of the uterus. Between them, in a cellular texture containing more or less fat, are placed on each side the ovarium, the fallopian tube and the round ligament; which have separate coverings, so as to project from the broad ligament, and have been called the alæ of the broad ligament.

SIDE VIEW OF THE PELVIS.

For general directions, see p. 269.

The *contents of the pelvis from the side* ought to be prepared in order to a better view of their relative position. The axes of the pelvis and trunk do not correspond; that of the former being oblique with respect to the latter. The contents of the pelvis partake of this oblique bearing, and are influenced by the form of the pelvis.

The *rectum* is straight at the lower extremity, but in the greater part of its course takes the curved direction of the sacrum. Before it lies the *vagina* taking a similar curve as it rises upwards, connected to the rectum behind, and to the bladder and urethra before, by cellular membrane. It is mo-

derately curved, and forms an obtuse angle with the uterus, with which it is connected above. The *bladder* is situated behind the ossa pubis, as in the male. Its broadest and most capacious part is placed inferiorly and posteriorly. It is proportionally larger than the bladder of the male, and is broader from one side to the other, corresponding to the cavity of the pelvis. The entrance of the ureter will be seen at its under and posterior part.

The *urethra* is much shorter, being only about an inch and a half in length, and straighter than in the male. It is attached to the arch of the pubes by two small fleshy slips, similar to those described in the male. It begins at the most depending part of the bladder. Its direction from the neck of the bladder is downwards and forwards, so as to make a slight curve. It terminates, as has been described, just below and behind the symphysis. Behind, it corresponds to the vagina, to which it is intimately connected; while before and above, it is attached to the symphysis, that is to say, to the triangular ligament. At the sides it is connected to the roots of the corpora cavernosa; and alike to all these parts by a quantity of very dense cellular membrane which surrounds the urethra, and forms part of the female prostate.

The urethra is composed of two kinds of structure: a dense spongy external one, in a great measure confounded with the cellular membrane, and an internal lining of *mucous membrane* continued from that of the vagina. It has longitudinal plaits or folds, and openings of mucous *follicles*, for the secretion of a fluid to prevent the irritating effects of the urine.

VAGINA. From its curve and oblique junction with the uterus, is longer posteriorly than anteriorly; its length is about three inches anteriorly, four and a half posteriorly. It is not cylindrical, being most capacious in its middle, and of an oval form, having its long axis from side to side.

Its structure principally consists of a *membranous substance* of some thickness. Near the orifice of the vagina, the *plexus retiformis*, or *corpus cavernosum vaginæ*, is placed; when cut into, it appears as if formed of cells, but is, in fact, composed of a plexus of veins.

The vagina is lined by a *mucous membrane* of a greyish colour, often interspersed with livid spots. It is chiefly remarkable for the number of folds, or *rugæ*, which its surface presents, at the upper part taking various directions, but at the lower part exhibiting a regular arrangement, and becoming more distinct. The rugæ run in a transverse direction, and are disposed in an anterior and posterior column; they join together laterally, and produce a raphe at the right and left sides. The whole extent of the vagina, particularly towards its outer extremity, is furnished with *follicles*, the orifices of which are frequently visible.

ROUND LIGAMENTS. *Ligamenta rotunda.* Are fixed to the edge of the uterus, superiorly and anteriorly to the fallopian tube. They pass outwards and a little upwards within the doubling of the broad ligament, so as to raise the anterior fold: then gain the internal abdominal ring, and pass downwards and inwards through the inguinal canal. Having cleared the external abdominal ring, they divide into three or four smaller bundles, which are lost in the mons veneris and labia, without attachment to the adjacent bone. The ligamenta rotunda are composed of vessels and of a bundle of longitudinal fibres, resembling those of ligament, which have been thought by some to be muscular.

REFLEXION OF THE PERITONÆUM WITHIN THE PELVIS. The uterus is anatomically divided into a body and cervix, besides which are distinguished its fundus, its corners and its sides. The peritonæum passes into the pelvis, leaving the lower end of the recti muscles to cover the fundus of the bladder. The anterior and upper portion of the bladder remains uncovered, and will be more or less exposed according to the distension of the bladder, and its consequent height above the pubes. The peritonæum afterwards gives a covering to the posterior surface of the bladder; it then forms two lateral folds and a pouch in the middle, similar to those in the male between the bladder and rectum; but less marked; and is reflected on to the anterior surface of the uterus, to the neck of which and part of the body it is loosely attached, the degree of covering of those parts varying according to the fulness of the bladder, which, when distended, carries the peritonæum up with it. It then gives a covering to the fundus and posterior surface of the uterus, passes a short way upon the corresponding surface of the vagina, and forms at the sides the broad ligaments before described. Behind the vagina the peritonæum is continued on to the rectum, and forms two (often irregular) lateral folds, and a pouch between.

The uterus and its appendages may now be dissected out in order to examine their structure:—

UTERUS. Is of a triangular figure, or rather like two triangles, a larger and smaller, which touch at their

apices: it has hence been compared to an hour-glass. It is flattened before and behind, but more so anteriorly. Its anatomical division has been already explained. The size of the uterus varies. In those who have borne children it is larger than in the virgin state. Internally, it has a *cavity* which resembles in figure the general form of the uterus, consisting of two parts, one large and triangular, belonging to the body, the other smaller and conical, belonging to the neck. The cavity is small in proportion to the organ, and its sides nearly touch. The under part of the cervix projects into the vagina, forming a rounded smooth *eminence*, surrounded by a circular depression about it where the vagina terminates, and is attached to the cervix. This projection is more or less considerable, and varies in form. It has an oval opening called the *os uteri*, or os tincæ. The projecting part of the cervix is smooth on its external surface, placed obliquely in a direction towards the back part of the vagina, and surrounded with mucous *follicles*, which in the impregnated uterus become very large.

The uterus is covered externally by the peritonæum. It is principally composed of a compact cellular and fleshy *substance*, plentifully supplied with blood-vessels. The appearance of muscular fibres is most distinct in the gravid uterus, especially about the orifices of the fallopian tubes. At that part an arrangement of *concentric* fibres is apparent, which has been called the *Musculus orbicularis Ruyschii*. It is remarkably vascular. The arteries, which are situated under the peritonæal coat, have an extremely tortuous course, and are derived from three sources, viz. part of the spermatic artery, the uterine artery, and part of the vaginal. The veins, which are situated within the substance of the uterus, have been called the *uterine sinuses*.

The uterus is lined by a fine smooth and vascular *membrane* of the mucous kind, naturally of a whitish colour, which has a porous appearance, more striking when seen through a lens.

The cavity of the cervix has two small longitudinal *lines* projecting into it, one in the anterior, the other in the posterior part; on each side of which are numerous *rugæ* running in a transverse direction. Between the rugæ are small *follicles* of the mucous kind.

FALLOPIAN TUBES. *Uterine Tubes*. Are two canals about four or five inches in length which are attached by one extremity to the corners of the uterus, and terminate ~~ing~~ in it, each by a small opening which scarcely admits the entrance of a bristle. Towards the uterus they are narrow, but become gradually larger in their passage toward the sides of the pelvis. Near their outer extremities they are unconnected, convoluted, and considerably dilated, and terminate by open and expanded mouths sufficiently large to admit the point of a goose-quill. About the orifices are the irregular pointed projections called *fimbriæ,* which are considerably longer on one side than on the other, (sometimes called *morsus diaboli.*) The canal of the tube is very minute at its origin within the uterus, but afterwards dilates.

The *substance* of the fallopian tubes has been supposed to be muscular. It is lined by a very delicate *membrane* probably of the mucous kind, but which it is extremely difficult to separate. It is chiefly remarkable for being furnished with many small longitudinal *plicæ,* which are most conspicuous towards the outer extremities.

Ovaries. *Ovaria.* Are situated at the sides of the fundus uteri, about an inch distant from it, and are contained in the posterior pinions of the ligamenta lata, which give them a complete covering except at the one edge, by which they are more or less closely fixed to the ligament. They are of an oval figure, flattened on their anterior and posterior surfaces; and the size of each, when in a state of maturity, is less than the male testicle. Their surface is irregular, and is, as it were, furrowed. They are attached to the uterus by a small fibrous cord about an inch and a half in length, placed behind and a little above the round ligament called the *ligament of the ovary.* The ovaria are internally composed of a loose whitish *cellular substance* contained within a white dense tendinous-like *membrane,* resembling somewhat the tunica albuginea. Within the cellular texture are vessels and nerves, and from fifteen to twenty *vesicles,* of which the largest are seldom equal to the size of a small garden pea. They are called the vesicles of *De Graaf;* are formed of a delicate membrane, which contains an albuminous fluid; and are supposed to include the rudiments of the fœtus.

SECTION V.

THE DISSECTION OF THE VESSELS AND NERVES.

CHAPTER I.

Preparatory Notices.

The Vessels and Nerves may be examined for the most part at one time; and as the student has already gone through the dissection of the other parts according to the preceding sections, he will be prepared to understand, without difficulty, their course and distribution, and will be enabled to recall and reimpress the knowledge of those parts which have been already described. During this dissection then his attention must be directed to the distribution of the arteries, veins, and nerves. The absorbent vessels cannot be well examined without a particular mode of preparation, and must therefore be deferred; but the glands will present themselves in the course of the dissection, and should be attended to. The dissection will proceed in the following order:

1. The Extremities, singly, with the arteries injected, for the dissection of the arteries, veins, nerves, and absorbent glands.

2. The Head, Neck, and Thorax, with the arteries injected, for the dissection of the arteries, veins, and absorbent glands. It would be inconvenient, if not impracticable, to dissect the nerves of the head and neck at the same time: therefore, for their particular examination, they may be dissected separately. The principal nerves may, however, be displayed.

3. The Abdomen and Pelvis, with the arteries injected, for the dissection of the arteries, veins, nerves, and absorbent glands. In this dissection the branches of the sympathetic nerve distributed to the viscera should be first traced, beginning at the semilunar ganglion and solar plexus.

In the dissection of all these parts the arteries should be followed from trunk to branch; and the veins and nerves, with the above exceptions, should be traced with them.

4. Head and Neck, for the dissection of the nerves. It is supposed that the course of the nerves within the cranium has been already examined, and consequently the course of the olfactory and optic ascertained. The order of the dissection of the rest will be—

1. That of the nerves on the side of the face, viz. the branches of the facial nerve and those of the fifth pair. 2. That of the nerves of the neck, beginning with the superficial branches of the cervical, and then proceeding to the deeper seated, viz. the lingual and its descending branch, the accessory nerve, the lingual branch of the third division of the fifth pair, the pneumogastric and sympathetic nerves and their branches, and the cervical nerves. All these nerves should be traced from above downwards. The lower jaw should then be divided to the outer side of the symphysis, and turned completely outwards, in order to see the trunk of the third division of the fifth pair and its dental branch, and those parts of the pneumogastric and sympathetic which could not be conveniently traced before. The upper part of the orbit may next be removed in order to trace the nerves distributed to the eye and its appendages. And lastly, the malar and superior maxillary bones may be removed in order to follow the branches of the second division of the fifth pair, and the sympathetic within the carotid canal.

In the description of the vessels and nerves which follows, the order of dissection is not laid down, as it would have been inconvenient for reference, and inadequate to a comprehensive view of their distribution; but by attending to the above directions they may be traced without difficulty.

v opposite the cartilage of the 4th rib and body of 4th Dorsal vertebra

x as high as the origin of the Arteria Innominata

CHAPTER II.

Of the Arteries.

§ I. AORTA.

The primitive trunks of the arteries, or those which arise from the heart, are the Pulmonary Artery and the Aorta.

The course and distribution of the pulmonary artery have been already given (p. 201.) We proceed, therefore, to the description of the Aorta.

The Aorta

Is the origin or common trunk of all the ramifications of the arterial system. It arises from the upper part of the left ventricle, from which it is distinguished at its commencement by difference of structure. It first ascends, then bends backwards and towards the left side, opposite to the third or fourth dorsal vertebra; after which it descends within the posterior mediastinum, inclined to the left side of the dorsal vertebræ; it passes between the crura of the diaphragm, and, continuing its course along the lumbar vertebræ, terminates at the fourth or fifth vertebra. The different portions of the aorta thus described as taking different directions, are distinguished by the corresponding names of—1. the *ascending* aorta, 2. the *curvature* or *arch* of the aorta, and 3. the *descending* aorta; the latter of which is divided into the *thoracic* and *abdominal* aorta.

inclining to
the right side

1. Ascending Aorta. Is enclosed during the greater part of its course by the pericardium. To its *left* is situated the pulmonary artery, which covers it anteriorly at its beginning: to its *right*, the vena cava superior; *behind* it, the right branch of the pulmonary artery: and *before* it, the sternum, from which it is separated by the anterior mediastinum.

2. Arch of the Aorta. Is situated immediately before the under end of the trachæa. The curve of the vessel being continued over the left bronchus, descends immediately behind it and the left pulmonary artery.

Sometimes, though rarely, the aorta bends back over the right bronchus, accompanied by varieties in the origin of the arteries from the arch. It sometimes divides into two trunks, one of which forms the descending aorta, and the other furnishes the branches to the head and upper extremities.

3. Thoracic Aorta. The aorta whilst descending in the thorax is placed in the posterior mediastinum. It has, to the *left*, the left pleura: to the *right*, the œsophagus, vena azygos, and thoracic duct: *anteriorly*, first the left bronchus, and then the œsophagus and pericardium: *behind*, the dorsal vertebræ.

4. Abdominal Aorta. The aorta in the abdomen, where passing on the bodies of the lumbar vertebræ, is situated more nearly on the median plane than the thoracic aorta on the bodies of the dorsal vertebræ. To the *right side* of the abdominal aorta is placed the vena cava inferior. It rests *behind* upon the vertebral column, is covered *anteriorly* and *to the left* by the peritonæum; and it terminates opposite the fourth or fifth lumbar vertebra by dividing into the common iliac arteries. The division is sometimes higher.

The arteries taking their origin from the aorta may be distinguished into those arising from the

1. Ascending aorta.
2. Arch of the aorta.
3. Thoracic aorta.
4. Abdominal aorta.
5. Termination of the aorta.

§ 1. BRANCHES FROM THE ASCENDING AORTA.

Are the coronary arteries which are described with the structure of the heart (p. 206.)

§ 2. BRANCHES FROM THE ARCH OF THE AORTA.

These supply the head and neck, the upper extremities, and in part the chest. They are three in number, the Unnamed Trunk, from which the Right Common Carotid and Right Subclavian Arteries arise, the Left Common Carotid and the Left Subclavian Artery.

The arteria innominata arises foremost and most to the right, the left carotid in the middle and somewhat farther back close to the unnamed trunk, and the left subclavian at a short distance from it, the most posteriorly and to the left.

The arteries do not always arise in this regular manner from the arch of the aorta. They vary occasionally both in situation and in number, the

× at the upper part but below the oesophagus is in front of the aorta

X internus

excess in the latter being the more common variety, as where the right carotid and right subclavian arise separately; or where in addition to the usual vessels, the vertebral, the inferior thyroideal, or more rarely the internal mammary arise from the arch; or where different combinations of these varieties are found. Thus sometimes four, occasionally five, and more rarely six vessels, are found to take their origin from the aorta. Occasionally, however, the number is less when two or all three arteries arise from a common trunk. Sometimes, the number remaining the same, the two common carotids arise from a single trunk, and the right subclavian originates separately from the aorta. The deviation from the usual *situation*, is when the arteries at their commencement are unusually close together, or separated from each other; or when the right subclavian arises between the carotids, or between the left carotid and the left subclavian. In the latter case it generally passes over to the right side between the œsophagus and trachæa.

I. Unnamed Trunk. *Arteria Innominata.*

It takes its course obliquely upwards and to the right, and generally divides after a passage of about an inch, but occasionally somewhat more, into the right common carotid, and right subclavian arteries. It is covered anteriorly by the sternum and sterno-thyroideus muscle, and is crossed by the left subclavian vein. Posterior to it is the trachæa. The right carotid and subclavian vessels are shorter than the left by the length of the unnamed trunk.

II. Common Carotid Artery. *A. Carotis Communis.*

Ascends in the neck, by the side of the air-tube, diverging in its course from the opposite artery of the same name. It reaches as high usually as the upper part of the larynx, where it terminates by dividing into the *external* and *internal carotid arteries.* Its situation above is superficial.

Anteriorly and *below* it is covered more or less by the sterno-cleido-mastoideus, sterno-hyoideus, sterno-thyroideus, and omo-hyoideus muscles; *anteriorly* and *above*, it is separated from the skin, aponeurosis and platysma myoides, by the projection of the parts about the larynx, and the sterno-mastoid muscle, to the edge of which it corresponds at this part, where it rises about an inch above the omo-hyoideus. *Posteriorly*, it has the vertebral column, the rectus capitis X ~~anticus~~ major and longus colli muscles, and the inferior thyroideal artery, a branch of the subclavian. To the *inner side*, it corresponds to the larynx and trachæa, the thyroid gland, which is sometimes continued partly over it, and to the œsophagus which is placed somewhat nearer to the left than the right trunk. To the *outer side*, the internal jugular vein, and the nervus vagus situated between it and the carotid, take their course: the nerve, the vein, and the artery are enclosed within a sheath of condensed cellular membrane. The sympathetic nerve is also situated on the outer side of the artery, but exterior to the sheath.

Sometimes one of the carotids crosses the lower part of the trachæa. The right, when the unnamed trunk arises much to the left; the left when it arises from the unnamed trunk. This variety requires caution in the operation of trachæotomy. The division of the common carotid into external and internal sometimes takes place higher than usual, and occasionally after the first branches of the external have been given off. A case has been observed in which the external carotid was a short stump from whence all the branches of the external came off at one point. The bifurcation sometimes takes place lower, than the part above described as the usual place. The place of division, with respect to the larynx, is the same in all ages, but is situated at a greater distance from the angle of the jaw in infancy before the teeth have been cut than at an after period, especially when the back part of the jaw is completely developed. In consequence of this, the branches of the external carotid are more exposed in the earlier periods of life.

The external and internal carotid arteries pass at first nearly perpendicularly upwards and parallel to each other. The external is situated nearer the larynx, and more anteriorly; the internal takes its course upon the muscles on the bodies of the vertebræ. Their size in the adult is nearly the same; but in infancy, owing to the larger proportional size of the brain, the internal is the more considerable vessel of the two.

a. EXTERNAL CAROTID. *A. Carotis Externa.*

The external carotid is continued as high as the neck of the lower jaw, where it terminates, by dividing into the temporal and internal maxillary arteries. It passes up first to the inner side of the posterior belly of the digastricus muscle and stylo-hyoideus to near the angle of the jaw; then continues its course between the mastoid process, and the ear, and the ascending plate of the lower jaw, covered by the parotid gland, to the place of its division.

The branches from the external carotid may be divided into the anterior, posterior, internal, and superior.

The *anterior* branches are three, viz. superior thyroideal, lingual, and facial.

1. SUPERIOR THYROIDEAL. *A. thyroidea superior.* Usually takes its origin from the root of the external carotid; but occasionally from the common carotid. Sometimes it arises from a trunk common to it and the lingual branch. It varies in size. It winds downwards, inwards, and forwards, covered by the omo and sterno-hyoideus muscles, to the upper part of the thyroid gland. It sends off

a. Branches to the sterno-mastoideus and omohyoideus muscles and to the superficial parts.

β. Laryngeal branch. (R.laryngeus.)—This passes forwards and inwards, and after distributing branches to the

muscles below the os hyoides, is continued usually between the os hyoides and thyroid cartilage, to be distributed to the muscles and lining membrane of the larynx.

γ. *Thyroid branch.* (R. thyroideus.) Is the continuation of the trunk. It generally divides into two branches, of which one is continued along the upper part of the thyroid gland, and anastomoses with a corresponding branch from the opposite superior thyroideal; the second passes along the outer and posterior part of the gland, and anastomoses with branches of the inferior thyroideal. Both send considerable branches to the substance of the gland.

2. LINGUAL. *A. lingualis.* Is somewhat larger than the superior thyroideal. It arises commonly just above the thyroideal, and sometimes from the same trunk as the facial. It takes its course upwards and forwards over the cornu of the os hyoides, becomes covered by the hyo-glossus muscle, and is continued forwards under the tongue. It gives off

α. *Branches* which are distributed to the adjacent muscles and pharynx.

β. *Hyoideal branch.* (R. hyoideus.) Distributed to the muscles above the os hyoides.

γ. *Dorsal branches.* (R. dorsales linguæ.) Distributed to the dorsum of the tongue, and to the parts about the passage of the fauces and pharynx.

δ. *Sublingual branch.* (R. sublingualis.) Supplying the sublingual gland and adjacent muscles.

ε *Ranine branch.* (A. ranina.) Is the continuation of the trunk. It passes forwards at the under and lateral part of the tongue, close to the frænum, and terminates near its point, furnishing in its course numerous branches.

3. FACIAL. *A. facialis, angularis, maxillaris externa.* Is generally the largest of the three anterior branches, and arises a little above the last. It varies, however, in size and origin. It passes upwards and forwards under the jaw behind the digastricus and stylo-hyoideus, and is then deeply embedded in the submaxillary gland. It is next continued upwards over the side of the jaw, and is situated superficially at the under and fore part of the masseter. It then passes towards the corner of the mouth, and, after making several turns, it proceeds by the side of the nose towards the inner angle of the eye. It sends off

α. *Inferior palatine branch.* (A. palatina inferior.) Distributed to the pharynx, velum palati, the tonsil, and parts adjacent.

β. *Glandular branches.* (R. glandulares.) Distributed to the submaxillary gland.

γ. *Submental branch.* (R. submentalis.) It is given off near the edge of the jaw, along which it is continued between the attachment of the mylo-hyoideus and digastricus muscles. It furnishes branches to both muscles, and is then continued upwards over the jaw to supply the muscles and skin of the lower lip, and anastomose with branches of the coronary and dental arteries.

δ. *Small branches.* Distributed to the masseter, and to the muscles and skin of the cheek and lips.

ε. *Inferior coronary artery of the lip.* (A. coronaria labii inferioris.) It passes along the under lip, covered by the membrane of the mouth; and, after furnishing branches to the adjacent parts, anastomoses with the opposite branch of the same name. This branch frequently varies both in origin and size. It sometimes arises higher, and is a branch of the superior coronary. Sometimes it is very small, and is wanting altogether on one side, in which case the opposite one is proportionably larger.

ζ. *Superior coronary artery of the lip.* (A. coronaria labii superioris.) Is larger than the former. It passes along the edge of the upper lip, furnishes branches to the adjacent parts, and inosculates with the opposite artery. The course of the coronary vessels is extremely tortuous. From the superior coronary there are branches (R. nasales septi) sent upwards to the point and partition of the nose.

η. *Branches.* Distributed to the nose, cheek, parts about the inner corner of the eye, and middle of the forehead; and by these branches the facial artery terminates.

The *internal branch* is the ascending pharyngeal.

4. ASCENDING PHARYNGEAL. *A. pharyngea adscendens, inferior.* Is the smallest branch of the carotid. It arises from the beginning of the external carotid, sometimes at the part where the common carotid divides, occasionally from the root of the internal, and not unfrequently from the occipital. It ascends in the same direction as the external carotid, between that vessel and the pharynx. It then divides into branches distributed to the constrictores pharyngis, sending off likewise a branch which passes through the lacerated opening of the base of the skull, and is dispersed upon the dura mater.

The *posterior branches* are the occipital and the posterior aural.

internal ?

5. OCCIPITAL. *A. occipitalis.* Is a vessel of some size, and nearly as large as the anterior vessels. It arises from the back part of the external carotid nearly opposite to the lingual or facial. It is rarely a branch of the internal carotid. It takes its course over the internal jugular vein, and then between the transverse process of the first vertebra and the mastoid process of the temporal bone. It is continued under the sterno-mastoid muscle, the trachelo-mastoideus, splenius, and complexus. It then becomes superficial, runs upwards upon the occipital bone, and divides into several branches. It gives off

a. Branches to the digastricus, sterno-mastoideus, and glands of the neck, and sometimes a branch through the foramen lacerum to the dura mater.

β. Descending branch, of considerable size, which passes down between the complexus and trachelo-mastoideus, and is distributed to the muscles at the back of the neck. It anastomoses with the vertebral.

γ. Branch which passes through the foramen mastoideum to the dura mater. This branch is not always found.

δ. Branches. These, by which the occipital artery terminates, are distributed to the occipito-frontalis and integuments, and anastomose with branches of the temporo-occipital and of the opposite occipital, so as to form a network of vessels.

6. POSTERIOR AURAL. *A. auricularis posterior.* Is smaller and arises higher than the former. It is often a branch of the occipital. It passes upwards behind the external carotid towards the mastoid process, is continued upon the back of the concha, and terminates upon the side of the head. It gives off

a. Branches to the parotid gland, the posterior belly of the digastricus, the stylo-hyoideus, and sterno-mastoideus.

β. Stylo-mastoid branch, (A. stylo-mastoidea,) which passes through the stylo-mastoid foramen, and is distributed to the meatus externus, membrana tympani, tympanum, and part of the labyrinth of the ear.

γ. Branches. Distributed to the ear and side of the head.

The *branches* by which the external carotid *terminates* are the temporal and internal maxillary.

7. TEMPORAL. *A. temporalis.* Is the smaller and more superficial. It is continued upwards in the same direction as the

external carotid before the ear, through the upper part of the parotid gland, and over the root of the zygoma. It passes to a short distance upwards, immediately under the skin, along the margin of the hair, and divides into two considerable branches, an anterior and posterior. It sometimes divides close to the zygoma. It gives off

α. *Branches* to the parotid gland.

β. *Branches*, (R. masseterici,) which are distributed to the masseter muscle.

γ. *Transverse of the face.* (A. transversalis faciei.) It arises near the division of the external carotid. It is sometimes, though rarely, a branch of the external carotid. It takes it course transversely over the masseter muscle, and accompanies the duct of the parotid gland. It distributes branches to the parotid gland and cheek, and communicates with the facial and infra-orbitar arteries.

δ. *Deep temporal.* It comes off near the zygoma, penetrates the aponeurosis of the temporalis, and ramifies within the muscle, forming communications with the deep temporal branches of the internal maxillary.

ε. *Anterior auricular branches.* Come off near the former, and are distributed upon the external ear and meatus.

ζ. *Anterior*, or *temporo-frontal branch.* It passes obliquely forwards, and divides into numerous branches; some of which are continued along the upper part of the forehead, are distributed to the skin, occipito-frontalis and orbicularis palpebrarum, and anastomose with branches of the supra-orbitar and facial. The rest pass upwards towards the vertex, and anastomose with the opposite artery and the temporo-occipital.

η. *Posterior*, or *temporo-occipital branch.* Passes obliquely upwards and backwards on the parietal bone. It distributes numerous branches to the side and upper part of the head, forming numerous anastomoses with the anterior branch of the opposite temporal, and with the occipital artery.

Many small vessels from the arteries on the head penetrate the substance of the bones.

8. INTERNAL MAXILLARY. *A. maxillaris interna.* Is larger than the temporal. It passes off from the external carotid where the latter is covered by the parotid gland. It takes its course first inwards and forwards behind the neck of the lower jaw, then inwards between the pterygoid muscles; it ascends, forming several turns, penetrates the pterygoideus

externus, passes behind the tuberosity of the superior maxilla in a horizontal direction, and terminates behind the orbit by dividing. It gives off

α. *Branches* of small size to the ear.

β. *Spheno-spinal,* or *middle artery of the dura mater.* (A. spheno-spinalis, duræ matris media vel magna.) It passes directly upwards. It distributes branches to the adjacent muscles, to the pharynx, and other parts near it. It is then continued through the foramen spinosum of the sphenoid bone, giving off some twigs to the bones and tympanum of the ear, and having entered the cranium, branches to the lower part of the dura mater. It next divides into two branches; the anterior, which is the more considerable, passes upwards and forwards to the anterior and inferior angle of the parietal bone, where it is lodged in the groove or canal at that part, and then divides into numerous branches which spread on the surface of the dura mater. The posterior ascends on the parietal bone and squamous portion of the temporal bone, and divides also into branches. The ramifications of these vessels are lodged in grooves in the bones.

γ. *Inferior maxillary branch.* (A. maxillaris, alveolaris, dentalis inferior.) It passes downwards, between the pterygoidei, to which it furnishes branches, to the inferior maxillary foramen. After having passed through this opening, it is continued through the canal of the inferior maxilla, distributing branches to the teeth and substance of the bones; then passes out through the mental foramen, and terminates in branches which anastomose with branches of the facial, and supply in part the chin and under lip.

δ. *Temporal branches.* (R. temporales profundi.) Are distributed to the temporal muscle.

ε. *Masseterine.* (R. massetericus.) Is a branch distributed to the masseter.

ζ. *Buccal.* (R. buccalis.) Is a branch distributed to the buccinator, and to the soft parts of the cheek.

η. *Pterygoideal branches.* (R. pterygoidei.) Are distributed to the pterygoidei muscles.

θ. *Alveolar branch.* (A. alveolaris, maxillaris, superior.) It arises behind the antrum, and takes its course around the superior maxilla, distributing branches to the teeth of the upper jaw, the substance of the bone, gums, and surrounding soft parts.

ι. *Infra-orbitar branch.* (A. infra-orbitaris.) Arises behind the orbit, passes through the infra-orbitar canal, and distributes branches in its course to the orbit, antrum, substance of the jaw, and the front teeth. It comes out at the infra-orbitar foramen, and terminates by branches to the cheek, some of which communicate with branches of the facial artery.

κ. *Descending palatine branch.* (A. palatina descendens, palato-maxillaris.) It gives off usually a branch to the upper part of the pharynx, called *superior pharyngeal.* It then descends in the palatine canal, and passing out through the palato-maxillary foramen, advances between the bone and membrane of the roof of the mouth, distributing branches to both. Anteriorly it communicates with the opposite artery, and sends a branch upwards through the ductus incisivus to the nose, to anastomose with branches of the lateral nasal; it also sends a branch through the palatine foramen to the tonsils and soft palate.

λ. *Lateral nasal branch.* (A. nasalis lateralis, posterior, spheno-palatina.) It takes its course through the spheno-palatine foramen, and divides commonly into two branches: one ramifying to the posterior ethmoid cells, and dividing into numerous branches to the septum of the nose; the other descending on the outer side of the nose, and supplying branches to the membrane covering the turbinated bones, and to the antrum maxillare.

b. INTERNAL CAROTID. *A. Carotis Interna.*

Ascends deep seated, and most commonly slightly curving in its course, upon the rectus capitis anticus major to the base of the cranium. It then turns forwards and upwards, and enters the carotid canal, and next adapts itself by several turns to the tortuous course of that canal, nearly filling it, but surrounded by a quantity of dense cellular membrane. On entering the cranium it passes upwards and forwards, by the side of the sella tursica, and is contained in the same fold of the dura mater as the cavernous sinus, but is protected from the blood which the sinus contains by the lining membrane of the sinus. Under the anterior clinoid process it bends upwards and then backwards, and divides into branches. Thus this vessel is very tortuous in its course, and changes its direction at least five or six times.

Exterior to the cavity of the cranium it seldom gives off any branches. Occasionally, however, it furnishes a branch to the pharynx, or to the fauces, and more rarely it gives off the occipital.

At the side of the sella tursica it commonly distributes small branches to the dura mater, ear, cavernous sinus, pituitary gland, and adjacent nerves.

Where it passes up under the anterior clinoid process, it detaches the

1. OPHTHALMIC, OR OCULAR ARTERY. *A. ophthalmica.* Is a branch of considerable size, which is distributed by numerous branches to the globe of the eye, its appendages, and adjacent parts. It passes with the optic nerve through the optic foramen, and generally below that nerve, and to its outer side; then takes its course between the levator oculi and nerve, on the inner part of the orbit. Its branches, which are subject to considerable varieties in origin, size, and number, are the

α. *Lachrymal,* which passes along the outer side of the orbit, and is distributed to the lachrymal gland, and parts adjacent.

β. *Central of the retina,* (A. centralis retinæ,) which passes into, and through the centre of the optic nerve, spreads upon the interior surface of the retina, and sends some branches through the vitreous humour.

γ. *Ciliary.* (A. ciliares.) Several in number, which pass by the sides of the optic nerve, and penetrate the sclerotic coat. They divide into branches which are distinguished as the short, (A. cil. breves vel posteriores,) distributed principally to the choroid coat; and as the long, (A. cil. longæ vel anteriores,) distributed to the iris, and forming the zona major and minor.

δ. *Muscular branches.* (R. musculares.) Supply the muscles, periosteum of orbit, eyelids, &c.

ε. *Ethmoidal.* (A. ethmoides.) Consisting of an anterior and posterior branch, which pass through the foramina orbitaria interna, anterius and posterius, and divide into branches to the membrane lining the nose, and sinuses connected with it.

ζ. *Supra-orbitar* branch, (R. supra orbitaris vel. frontalis,) which passes along the upper part of the orbit, is continued through the foramen supra orbitare, and is distributed upon the muscles and skin of the forehead.

η. *Internal angular,* or *nasal* branch, (R. nasalis,) which takes its course to the inner angle of the eye, is distributed to the adjacent parts of the nose, eyelids and forehead, and anastomoses with branches of the facial artery.

ARTERIES OF THE CEREBRUM.

After giving off the ophthalmic, the internal carotid furnishes the branches which supply the fore part of the cerebrum. It distributes a few branches to the infundibulum, pituitary gland, optic nerve, and third ventricle: then sends a branch backwards, which from forming a communication with the basilary artery is called the communicating, and afterwards terminates by dividing into the anterior and middle arteries of the cerebrum.

2. COMMUNICATING. *A. communicans.* The size of this branch varies, but is generally considerable. It takes its course backwards, and terminates in a branch of the basilary, namely, in the posterior artery of the cerebrum, so as to assist in forming the circle of Willis. It distributes some branches to the base of the cerebrum.

3. ANTERIOR. *A. anterior cerebri, A. corporis callosi.* Passing forwards and inwards, it approaches the opposite artery of the same name, and after sending some small branches to the anterior lobe and to the olfactory and optic nerves, is joined to that artery, before the union of the optic nerves, by means of a short but large TRANSVERSE branch, *A. communicans anterior transversa.* From the transverse branch branches are sent off to the third ventricle, septum lucidum, and fornix. The anterior artery is then continued upwards, and bends backwards over the corpus callosum upon the internal and flat surface of the hemisphere. It divides into branches, some of which are of small size, and distributed to the corpus callosum, whilst the larger and more numerous pass between the convolutions, others spread on the surface of the hemisphere, but are all directed towards the upper part. They ramify, divide minutely, and freely anastomose in the pia mater, covering the fore and inner part of the hemisphere, and send only minute, but numerous branches into the substance of the brain.

4. MIDDLE. *A. media cerebri, fossæ Sylvii.* Is always considerably larger than the anterior. It passes outwards and a little forwards, and then takes its course through the fissura Sylvii upwards. It sends some twigs into the descending cornu of the lateral ventricle, and then divides into three or four considerable branches, which pass up on the anterior and middle lobes to the upper surface of the hemisphere, spreading into numerous branches upon the pia mater, which send twigs into the brain, and freely communicate with branches of the anterior and posterior arteries of the cerebrum.

5. BRANCH TO THE CHOROID PLEXUS OF THE LATERAL VENTRICLE. Passes over the crus cerebri to the anterior opening

of the lateral ventricle, and distributes branches to the thalamus nervi optici. Not always met with.

The origin of the cerebral arteries is not always constant and symmetrical, as above described; occasionally both the middle arteries arise from the right carotid, and the anterior only from the left.

III. SUBCLAVIAN ARTERY. *A. Subclavia.*

The difference of the origin of the subclavian artery on the right and left side has been already remarked; the left arising immediately from the arch of the aorta, and the right from the unnamed trunk. The varieties occasionally met with in their origin have been also noticed. They both pass upwards through the upper opening of the chest, bend outwards over the first rib, are continued between the scaleni muscles, outwards and downwards; and having descended below the clavicle, change their name to that of the *axillary* arteries.

In consequence of the difference of origin of these arteries on the right and left side, they differ before they pass over the first ribs, in—α. *Situation*, the right being more superficial; the left deeply hid [arising farther back from the arch of the aorta].—β. *Length*, the right being shorter by the length of the arteria innominata.—γ. *Direction*, the right passing obliquely upwards and outwards to the space between the scaleni, whilst the left passes first vertically upwards, then suddenly bends outwards between the scaleni.—δ. *Relative position*, the right being placed more anteriorly, near to the apex of the right lung on the outer side, and separated, behind, from the vertebral column and longus colli, to which it corresponds; the left being covered from its origin by the corresponding lung, and closely applied to the longus colli.

The course of the subclavian arteries, after their arrival at the space between the scaleni, becomes the same. *Anteriorly*, they have the scalenus anticus interposed between them and their correspondent veins, and then the subclavian vein and the clavicle, which latter they pass at an acute angle. *On the inner side*, they have the first rib, to which they are closely applied, thus affording the means of ready compression: and *upon* the first rib, and *before* they have passed it, they have the pleura immediately adjacent to them, at the part where the pleura reaches above the upper opening of the chest, and terminates in a blind extremity. *Behind*, and *to the outer side*, are situated the nerves which form the axillary plexus.

The branches from the subclavian are divided—into the *Superior*, which consist of the—1. Vertebral—2. Inferior thyroideal—3. Ascending cervical—4. Supra-scapular—5. Superficial cervical—6. Deep cervical: and—into the *Inferior*, which consist of the—7. Internal mammary, and—8. Superior intercostal. These branches are commonly given off just before the artery passes between the scaleni muscles: but they differ considerably—1. in size, as they do not always furnish the same branches:—2. in number, in consequence of two or more coming off from a single trunk, and—3. in the point of origin, arising more inwards or outwards from the trunk. Sometimes small branches are supplied before these are given off to the pericardium, trachæa, bronchia, and œsophagus.

1. VERTEBRAL. *A. vertebralis.* Is commonly the first and largest branch. It arises sometimes from the arch of the aorta; this variety rarely takes place, except on the left side, and then seldom elsewhere but between the left carotid and subclavian arteries. It then passes upwards and through the opening in the transverse process of the sixth cervical vertebra, rarely through that of the seventh, but oftener through that of the fifth, fourth, or third. It is sometimes larger on one side than on the other. It is then continued through the openings of the transverse processes of the vertebræ above, nearly in a straight direction, as far as the second vertebra, but then becomes tortuous in its course: it forms one bend between the first and second vertebræ, and after passing through the transverse process of the atlas, it changes its direction, becomes horizontal, and bends round the root of the articular process in the groove for receiving it; it passes under the occipital bone to the foramen magnum, upwards through the latter, and through the dura mater, and is then continued at first on the side of, and then below, the medulla oblongata, upon the cuneiform process of the os occipitis upwards and inwards. The two arteries thus approaching each other, after the course of about an inch within the cranium, unite at an acute angle near the posterior edge of the pons Varolii, or upon it, forming the BASILARY ARTERY, *A. basilaris.* This passes along the middle of the under surface of the pons, and divides near its anterior edge into four principal arteries, viz. the two superior arteries of the cerebellum, and the two posterior arteries of the cerebrum.

The *vertebral* gives off before entering the cranium:

a. Branches to the deep muscles of the neck, some which pass through the vertebral foramina, and are distributed to the membranes of the spinal marrow, and others (and these the larger) at the upper part of the neck distributed

to the trachelo-mastoideus, transversalis colli, and to the recti and obliqui capitis.

After entering the cranium it gives off

β. *Posterior artery of the spinal marrow,* a branch of small size, which passes to the posterior surface of the spinal marrow, and descends on each side along the groove of the medulla to its inferior extremity. It is extremely tortuous in its course, and during the whole of its descent is joined and augmented by branches of the vertebral, cervical, and intercostal arteries, which pass through the vertebral foramina.

γ. *Inferior of the cerebellum.* (A. cerebelli inferior.) Arises from the outer side of the vertebral, and is frequently double (on one or both sides.) Sometimes one or both arise from the basilary. It passes backwards and outwards between the cerebellum and medulla oblongata, distributes branches to the choroid plexus of the fourth ventricle, ascends between the lobes of the cerebellum, and furnishes branches which ramify on its pia-matral covering.

δ. *Anterior of the spinal marrow.* Comes off near the junction of the vertebral arteries, descends and unites with its fellow, forming a branch which takes its course along the anterior groove of the spinal marrow. It divides, subdivides, and anastomoses frequently during its course, forming communications with branches of the vertebral and other arteries.

Branches of the BASILARY ARTERY.

α. *Branches* from both sides, varying in size and number to the pons Varolii, and adjacent parts.

β. *Internal auditory,* (A. auditiva interna,) to the internal organ of hearing, after passing through the meatus auditorius internus.

γ. *Superior of the cerebellum,* (A. cerebelli superior,) is sometimes double on one side. It passes outwards near the anterior edge of the pons Varolii, and then over the pons backwards to the cerebellum, dividing into branches which spread on its upper surface, are continued to its posterior edge, and anastomose with the inferior branches.

δ. *Posterior of the cerebrum,* (A. cerebri posterior,) is much larger than the former. It passes outwards, and after sending branches to the crus cerebri, thalamus nervi optici, and corpora quadrigemina, it is joined by the communicating branch of the internal carotid. It then continues its course upwards and outwards round the crus cerebri, furnishing branches to the choroid plexus of the third ventricle, and to the parts near which it passes; then divides into branches to the posterior part of the hemisphere, especially to its under surface, to the corpus callosum and thalami, and these freely communicate with branches of the anterior and middle arteries of the cerebrum.

The other branches given off from the subclavian artery are

2. INFERIOR THYROIDEAL. *A. thyroidea inferior.* It arises farther out than the vertebral, and is a branch of considerable, but varying, size; and the branches into which it divides are not constant. Sometimes the ascending, the suprascapular, the superficial, and the deep cervical branches are given off from this artery or arise from a common trunk. Occasionally it sends off the internal mammary. It passes upwards and bends inwards behind the common carotid, seldom before it, to the thyroid gland; then divides into a number of branches, which penetrate the under part of the gland, and anastomose with branches of the opposite inf. thyroideal and of the superior thyroideal on the same side. It distributes branches to the longus colli, some that pass through the vertebral foramina, and others that pass to the air-tube and œsophagus. The continuation of the trunk to the thyroid gland is distinguished by the name of the *thyroideal branch*, (R. thyroideus.) Sometimes there is a separate branch to the thyroid gland from the common carotid, from the unnamed trunk, or from the aorta (A. thyroidea ima,) the last of which passes over the fore part of the trachæa, and would, therefore, be in danger in the operation of trachæotomy.

3. SUPRA-SCAPULAR. *A. transversa scapulæ, dorsalis superior scapulæ.* It takes its course transversely outwards behind and a little above the clavicle, generally before, but sometimes behind the scalenus anticus, distributing branches to the muscles of the inferior hyoideal region and to the neighbouring muscles. It is continued to the superior costa of the scapula, over the ligament of ~~passes through~~ the notch ~~up~~on to the dorsum of the bone, then takes its course between the spine and glenoid cavity to the fossa infraspinata, and anastomoses by one or more branches with the dorsal branch of the infra-scapular. It furnishes branches to the spinati muscles, to the adjacent muscles of the shoulder, and to the shoulder-joint.

4. ASCENDING CERVICAL. *A. cervicalis adscendens.* Ascends along the transverse processes of the cervical vertebræ between the longus colli and scalenus anticus. It distributes branches to the muscles, which are attached to the

cervical vertebræ, and to those of the back of the neck; at the upper part of the neck it bends backwards, furnishing branches to the muscles under the occiput, and anastomoses with branches of the vertebral and occipital arteries.

5. SUPERFICIAL CERVICAL. *A. cervicalis superficialis, transversa colli.* Is commonly larger than the former, it passes nearly transversely outwards, bends backwards, and commonly divides into two branches near the superior costa of the scapula, one of which passes upwards and the other downwards. It supplies branches to muscles situated at the back part of the neck, shoulder, and chest; and communicates with branches of the occipital and vertebral.

6. DEEP CERVICAL. *A. cervicalis profunda.* Arises generally farther out than the last, and after the subclavian has passed between the scaleni muscles; it then bends upward and outward, is in part concealed in its course by the nerves which form the axillary plexus, and divides into branches principally distributed to the deep-seated muscles at the back of the neck, often furnishing a branch which passes in the direction of the base of the scapula. It sends, likewise, small branches through the vertebral foramina, and others which communicate with branches of the vertebral and occipital arteries.

The *inferior* branches are

7. INTERNAL MAMMARY. *A. mammaria interna.* It comes off from the subclavian artery nearly opposite to the inferior thyroideal branch, then descends nearly straight within the chest behind the cartilages of the ribs, near the edge of the sternum between the intercostales interni and sternocostalis; nearly opposite to the sixth or seventh rib, it divides into two branches, the epigastric. It furnishes in its course various branches:

α. *Thymic,* (R. thymici,) which are distributed to the thymus gland.

β. *Pericardiac,* (R. pericardiaci,) which are distributed to the pericardium.

γ. *Mediastinal,* (R. mediastini,) which are distributed to the mediastinum.

δ. *Branch* accompanying the phrenic nerve (R. comes nervi phrenici.) Distributed principally to the diaphragm.

ε. *Intercostal,* (R. intercostales,) which pass outwards in the spaces between the true ribs, to which commonly they correspond in number, and after distributing branches to the intercostal muscles, anastomose with the aortic intercostals. Others pass between the ribs to the exterior of the chest, distributed to the soft parts, and to the muscles of the abdomen.

ζ. *Phrenic,* (R. musculo-phrenicus,) which divides into branches to the diaphragm and abdominal muscles.

η. *Epigastric,* (R. epigastrici,) which assist in the supply of the parietes of the abdomen and anastomose with branches of the epigastric branch of the external iliac artery.

8. SUPERIOR INTERCOSTAL. *A. intercostalis suprema.* It arises more outwards, and from the back part of the subclavian; and is a branch of small, but variable, size. It passes down over the neck of the first rib, sends branches to the deep muscles of the neck, some of which pass through the vertebral foramina, and then divides into two or three branches, which are distributed to the two or three uppermost intercostal spaces.

AXILLARY ARTERY. *A. Axillaris,*

Which is the continuation of the subclavian, passes outwards and downwards to the lower edge of the tendon of the latissimus dorsi, and there changes its name to that of the *brachial* artery.

The axillary artery in its course through the axilla: *Anteriorly,* is covered by the pectoralis major and minor: it is accompanied by the axillary vein, which, opposite to the head of the humerus, sinks rather below it; and at that part the nerves of the axillary plexus pass before it. *Posteriorly*, it is opposite to the space, between the serratus magnus and subscapularis muscles, filled by cellular membrane and fat; and is accompanied by the nerves forming the axillary plexus. To the *inner* side it is at first near to the second rib and serratus magnus; it is then inclined outwards from the parietes of the chest, the intervening space being occupied by fat and cellular membrane, in which several absorbent glands are placed. To the *outer* side, in its passage between the clavicle and coracoid process, are situated in part the nerves forming the axillary plexus; but these passing forwards like those from behind, it is then close to the capsular ligament of the shoulder-joint. The artery may be conveniently laid bare by carrying an incision downwards and outwards to a point opposite the coracoid process of the scapula, through the integuments and clavicular slip of the pectoralis major, then by pursuing the dissection between the subclavius and the edge of the pectoralis minor, during which the cephalic vein and branches of

the humeral thoracic artery are to be avoided: the artery will be found directed outwards and downwards, with the accompanying vein before it, and the nerves of the axillary plexus behind and to the outer side.

The branches of the axillary artery are the external thoracic, the infra-scapular, and the circumflex of the upper arm. These branches present numerous varieties in number, size, and origin; chiefly in consequence of two or more arising from a common trunk. Occasionally the supra-scapular takes its origin high up from the axillary.

EXTERNAL THORACIC. *A. thoracicæ externæ.* Are commonly three or four in number: viz.

1. SUPERIOR THORACIC. *A. thoracica suprema, prima.* It arises commonly nearly opposite the second rib, and takes its course downwards and forwards upon the exterior of the chest. Sometimes there are two instead of one. It is distributed to the intercostales externi, pectoralis minor, subscapularis, serratus magnus, to the axillary glands and skin.

2. HUMERAL THORACIC. *A. thoracica humeraria.* It arises near the beginning of the axillary artery. Sometimes there are two branches instead of one. It divides almost immediately into branches distributed to the pectorales, to the deltoid, to the muscles about the shoulder, and to the shoulder-joint. One branch most commonly takes its course along the edge of the deltoid, between it and the pectoralis major.

3. LONG THORACIC. *A. thoracica longa, mammaria externa.* It frequently arises from the infra-scapular. It passes forwards upon the chest, and supplies branches to the serratus magnus, pectoralis major, to the integuments, and in the female to the mamma.

4. ALAR THORACIC. *A. thoracica axillaris, alaris.* Is sometimes a separate branch, detached near to the humeral thoracic, and assisting in the supply of the axillary glands, pectoralis, serratus and subscapularis muscles. The external thoracic branches anastomose with branches of the intercostal arteries.

The other branches from the subclavian artery, are—

5. INFRA SCAPULAR. *A. infra-scapularis, subscapularis.* Is, in general, the largest branch from the axillary artery. It arises, commonly concealed by the axillary plexus, opposite the lower edge of the subscapularis muscle, along which it takes its course, but soon divides into an internal and a dorsal branch.

α *Internal scapular* (R. scapularis internus) continues in the course of the trunk, along the under edge of the subscapularis, then passes upon the side of the chest directed downwards and backwards, and supplying branches to the subscapularis, teres major, latissimus dorsi, serratus magnus, and to the axillary glands.

β. *Inferior dorsal of the scapula* (R. dorsalis scapulæ inferior) gives off branches to the subscapularis, and to the teres major and minor; then passes round the ~~neck of the scapula, between the subscapularis and teres major~~ to the dorsum of the bone upon which it gives off many branches to the infra-spinatus. The artery is then continued to the root of the acromion, where it anastomoses with the superior dorsal of the scapula, and thus a passage for the blood is preserved under the obstruction of the trunk of the subclavian and axillary arteries between the origin of the superior dorsal and infra-scapular branches.

There are two circumflex arteries of the arm—an anterior and a posterior; viz.

6. ANTERIOR CIRCUMFLEX. *A. circumflexa anterior, articularis anterior.* Is smaller than the posterior. It arises just above the edge of the tendon of the latissimus dorsi, and then passes outwards round the os humeri, between it and the common origin of the coraco-brachialis and biceps, just below the head of the bone. It sends branches upwards to the shoulder-joint and parts adjacent, some of which anastomose with the dorsal artery of the scapula; and is then continued under the deltoid muscle, supplying it with branches, by which it terminates, and which anastomose with branches of the posterior circumflex artery.

7. POSTERIOR CIRCUMFLEX. *A. circumflex posterior, articularis posterior.* Is the larger of the two. It arises frequently from the infra-scapular, or from a trunk in common with the profunda humeri, and occasionally in common with the anterior circumflex artery. It passes backwards between the teres minor and major, and then round the os humeri, below its head, between the bone and the long head of the triceps, and is continued to the inner surface of the deltoid muscle. In its course it distributes branches to the long head of the triceps, to the shoulder-joint, teres minor, &c. and terminates by dividing into branches to the deltoid, some of which anastomose with branches of the anterior circumflex, infra-scapular, and dorsal scapular branches.

inferior costa of the Scapula usually through the teres minor

× accompanied by the articular nerve

+ radial

BRACHIAL ARTERY. *A. Brachialis.*

Passes from the axilla to below the bend of the elbow where it terminates by dividing into the radial and ulnar arteries. During the greater part of its course it is situated to the inner side of the arm. As it descends, it is placed more superficially and anteriorly; at the bend of the elbow it is opposite to the middle of the articulation.

Anteriorly:—It has first the edge of the coraco-brachialis, which more or less covers it. In the greater part of the rest of its course it corresponds, and is nigh to the inner edge of the biceps muscle. At the bend of the elbow it is covered by the aponeurosis of the biceps muscle, and is crossed by the basilic median vein. *Posteriorly*:—It has the triceps, from which it is separated by fat and cellular membrane; passes over the os humeri, and, inferiorly, is continued down upon the brachialis internus. *To the inner side*:—It is immediately adjacent to the brachial vein and median nerve, which latter is placed rather anteriorly; it is separated from the skin by fat and cellular membrane. *To the outer side*:—It has the coraco-brachialis, which separates it from the os humeri: as it descends it corresponds to the biceps, and near its termination to the tendon of that muscle.

The branches which it gives off are one or two deep branches, and other small branches to the muscles.

1. DEEP HUMERAL. *A profunda humeri.* Arises commonly near the edge of the tendon of the latissimus dorsi; passes then outwards and downwards, accompanied by the ~~spiral~~ nerve, between the heads of the triceps, and behind the os humeri. It supplies numerous branches to the heads of the triceps in its course, and commonly furnishes the nutritious artery (A. nutritia) of the os humeri (which, where this is not the case, arises from the brachial itself.) Its divisions anastomose with branches of the scapular and circumflex arteries. It gives off

a. Communicating radial, (R. communicans radialis,) which passes from behind the os humeri, and is continued on its outer side as far as the outer condyle, furnishing branches to the biceps and brachialis internus, and anastomosing with the recurrent radial branch of the radial artery.

2. INFERIOR DEEP HUMERAL. *A profunda inferior, minor.* Comes off lower than the former. It is sometimes a branch

of the profunda superior, and is then called the *communicating ulnar* (R. communicans ulnaris.) It descends upon the triceps on the inner side of the arm distributing branches to it, and anastomoses below with the recurrent ulnar branch of the ulnar artery, and recurrent interosseal branch.

3. MUSCULAR BRANCHES, variable in size and number, and distributed to the biceps, coraco-brachialis, brachialis internus, which are given off during the course of the brachial artery.

4. ANASTOMOTIC BRANCH. *R. anastomoticus.* Arises about two inches above the elbow; passes inwards over the brachialis internus, furnishing branches both to it, and to parts about the elbow-joint; inosculates behind the inner condyle with the recurrent ulnar, and thus communicates with the other anastomosing branches.

The place at which the brachial artery divides into radial and ulnar arteries has been already described as just below the bend of the elbow upon the tendon of the brachialis internus. Sometimes, though rarely, the division takes place lower down. But it frequently takes place higher up, at any point between the usual place of division and the axilla. In this latter case, the radial takes its course superficially; and the ulnar sometimes passes in the situation of the brachial artery, but occasionally superficially, being continued over the heads of the flexor muscles between the fascia and skin. Sometimes the common interosseal is given off in the upper arm. Another variety is that sometimes one or more considerable additional branches (vasa aberrantia) are given off from the upper part of the brachial, and after descending superficially terminate in the lower part of the brachial, or more commonly in one of the arteries of the fore arm, especially the radial. These varieties are found on one or both sides, more commonly on both: they are important with respect to surgical practice, as in the greater number of instances above cited they would be more exposed to injury, but would at the same time allow a more ready passage for the blood when its course through the principal trunk had been obstructed; and they would also cause difficulty in operation.

RADIAL ARTERY. *A. Radialis.*

Is commonly smaller than the ulnar, but is continued more in the direction of the brachial, and situated more superficially.

It passes down in the course of the radius as far as the wrist. During its passage through the fore arm : *posteriorly*, it corresponds to the radius, but is separated from it above by fat, cellular membrane, and the supinator radii brevis, lower by the pronator teres ; it is then situated on the flexor pollicis longus, and below upon the pronator quadratus, and on the radius itself. On the *inner side* is placed the pronator teres, flexor sublimis, and flexor carpi radialis. On the *outer side* it has the supinator radii longus, and is accompanied in part of its course by the superficial branch of the radial nerve. *Anteriorly*, it is covered by the skin and aponeurosis of the fore arm, from which, however, it is separated, *above*, by fat and cellular membrane, and, *below*, by the projection of the flexor carpi radialis and supinator longus at the sides ; but where these muscles become tendinous the artery is immediately beneath the integuments, so that its pulsations can be readily felt. *At the wrist* it bends backwards, commonly between the trapezium and the tendons of the extensor ossis metacarpi, and extensor primi internodii, pollicis, or sometimes higher, to the space between the metacarpal bones of the thumb and fore finger. It is continued through the abductor indicis into the palm of the hand, where it terminates by forming the deep-seated palmer arch.

The branches which the radial gives off are

1. RECURRENT RADIAL. *A. radialis recurrens.* Comes off usually near the beginning of the radial, and is a branch of considerable size. It passes up on the inside of the supinator radii longus, then between it and the extensor carpi radialis longior, and near the olechranon inosculates with the communicating radial branch of the deep humeral. It furnishes branches in its course to the supinatores, extensores radiales, brachialis internus, and to the elbow-joint.

2. MUSCULAR BRANCHES. *R. musculares.* The radial in its course gives off numerous branches, mostly of small size, to the pronator teres, flexor carpi radialis, flexor sublimis, flexor pollicis longus, pronator quadratus, and to the wrist-joint.

3. SUPERFICIAL PALMAR. *A superficialis volæ.* Is a branch of variable size, which comes off near the wrist and passes down superficially close to the tendon of the palmaris longus to the palm of the hand. When small, or sometimes even when of considerable size, it is entirely expended on the muscles which form the ball of the thumb. When of large size it commonly joins with the ulnar in forming the superficial palmar arch; in which case, sometimes besides the

branches to the muscles of the thumb, it sends a branch along its outer side, occasionally a branch along its inner side, and furnishes the radial branch of the fore finger. In some cases, the superficial branch arises high up and takes the course of the radial artery, but more superficially, so that its pulsation might be mistaken for that of the radial artery.

4. SMALL BRANCHES. Distributed to the ligaments and other parts about the wrist.

5. DORSAL BRANCHES. Variable in size and number to the back part of the carpus, metacarpus, to the interossei muscles, and to the back part of the thumb and fore finger.

In the palm of the hand the radial artery passes inwards, is called the deep palmar branch, and forms the *deep-seated palmar arch,* which joins with the deep branch of the ulnar artery. It furnishes also the

6. LARGE ARTERY OF THE THUMB. *A magna pollicis.* This is usually given off on the metacarpal bone of the fore finger, takes its course on the inner side of the metacarpal bone of the thumb, and either divides into two branches, one of which passes along the outer and the other along the inner side of the thumb to its extremity, or furnishes only one of these branches, the other being supplied either from the superficial or deep palmar arch.

7. RADIAL BRANCH OF THE FORE FINGER. *A. radialis indicis.* Passes along the outer side of the fore finger to its extremity.

ULNAR ARTERY. *A. Ulnaris.*

Is usually a more considerable artery than the radial, and is deeper seated in its course. As it descends it bends inwards and takes its course in the direction of the ulna, is then continued into the palm of the hand, and terminates by forming the superficial palmar arch.

Anteriorly:—It is at first covered by the pronator teres, palmaris longus, flexor carpi radialis, and flexor sublimis, but lower is more superficial, being separated only from the aponeurosis and skin by the projection of the flexor sublimis and flexor carpiulnaris at the sides. *Posteriorly*:—It is placed on the flexor digitorum profundus. *On the inner side*:—It has the flexor carpi ulnaris, and is accompanied by the ulnar nerve. *On the outer side*:—It has the flexor sublimis. *At*

the wrist it has behind it the ligamentum carpi annulare, a small slip of which usually passes before it: and, on the inner side, the os pisiforme. In the *palm of the hand* it has behind it the tendons of the flexors of the fingers, and is only covered by the aponeurosis and skin.

Its branches are

1. RECURRENT ULNAR. *A. recurrens ulnaris.* Is a branch of considerable size. It is commonly the first, but a smaller muscular branch sometimes is first given off. It passes upwards between the sublimis and profundus, and through the flexor carpi ulnaris, furnishing branches to these muscles, as far as the hollow between the inner condyle and olechranon, and inosculates with the lesser deep and with the anastomosing branch of the brachial artery. It is sometimes, in the case of a high division, a branch of the interosseal artery.

2. INTEROSSEAL. *A. interossea.* Is a branch of considerable size. It is sometimes a branch of the brachial artery, and in a high division is usually given off by the radial. It furnishes one or two branches to the adjacent muscles, and then divides into two nearly equal branches, that occasionally come off separately, viz. the anterior and posterior interosseal branches.

a. *Posterior interosseal.* (R. interosseus posterior.) Passes backwards through the hole in the interosseous ligament. It then gives off the *recurrent interosseal,* (A. recurrens interossea,) which passes upward between the radius and ulna, and inosculates upon the back part of the elbow with the other anastomosing branches of the humeral, radial, and ulnar arteries, forming with these a plexus of vessels at this part. After detaching this branch the posterior interosseal is continued downwards between the extensors of the thumb and that of the fingers, furnishing branches in its course to these muscles, and reaches as low as the wrist.

β. *Anterior interosseal.* (R. interosseus anterior.) Is the larger of the two; it takes its course downward upon the anterior surface of the interosseous ligament, and furnishes branches to the flexor muscles, some which perforate the interosseous ligament, and supply the extensors; it also gives off commonly the nutritious arteries of the radius and ulna. Near the edge of the pronator quadratus it passes through the interosseous ligament, and divides into branches which, upon the back of the carpus and hand, anastomose with branches of the posterior interosseous and dorsal branches of the radial and ulnar arteries, forming with these a plexus, from which branches pass to the back part of the hand and fingers.

3. MUSCULAR. *R. musculares.* The ulnar, like the radial artery, furnishes numerous branches in its course along the fore arm to the adjacent muscles, the flexor carpi ulnaris, and flexors of the fingers.

4. DORSAL. *A. dorsalis ulnaris.* Comes off near the extremity of the ulna, passes backward under the tendon of the flexor carpi ulnaris, and after furnishing branches to the adjacent parts, joins with the branches which form the plexus at the back of the wrist.

5. DEEP ULNAR. *A. ulnaris profunda.* Passes deep into the palm round the flexor of the little finger, is continued outwards, and inosculates with the radial forming the deep palmar arch, situated near the bases of the metacarpal bones. It furnishes interosseal branches to the interossei muscles, which anastomose at the roots of the fingers with the digital branches of the superficial arch, and other branches which pass between the metacarpal bones to the back of the hand.

The ulnar artery then passes outward over the tendons of the flexor muscles, and forms the *superficial palmar arch*, (arcus superficialis volæ.) This is placed with its convex side downwards, and anastomoses frequently with the superficial palmar branch of the radial on the outer side of the hand or with the large artery of the thumb. It furnishes branches to the fingers, called

6. DIGITAL. *A. digitales.* Which consist of

α. *Branch* which passes along the inner side of the little finger.

β. *Three considerable branches* which arise in succession, and pass to the interstices between the fingers, where each divides into two branches, one of which passes along the outer or radial side of one finger, and the other passes along the inner or ulnar side of the finger next to it; so that the first supplies the little and ring fingers, the second the ring and middle fingers, and the third the middle and fore fingers. There are several varieties in their size and origin, but not usually in the mode of distribution above indicated. After giving off in their course small branches to the fingers, they divide and form an intricate plexus at the tip of each finger.

The superficial arch sometimes supplies the branches to the thumb and fore finger usually given off from the radial artery.

§ 3. BRANCHES FROM THE THORACIC PORTION OF THE DESCENDING AORTA.

Numerous branches are given off from the aorta in its passage through the chest, but they are so inconsiderable that the aorta is not sensibly diminished in size. These vessels are subject to frequent varieties. They are :—

1. Bronchial. *A. bronchiales.* These vary considerably in number and size. The right upper is commonly a branch of the uppermost aortic intercostal; but sometimes arises immediately from the aorta. The left arises about an inch below the arch of the aorta; it is the larger of the two, and usually sends a branch to the right bronchus. There are sometimes one or two inferior. Occasionally there is only one bronchial artery. The bronchial arteries give off branches to the œsophagus, the mediastinum and the pericardium, and accompany the bronchia into the lungs.

2. Œsophageal. *A. œsophageæ.* Are small branches variable in size and number distributed to the œsophagus and adjacent parts.

3. Mediastinal. *A. mediastinales.* Are small branches distributed to the œsophagus, to the mediastinum, and to the aorta itself.

4. Intercostal. *A. intercostales.* They supply chiefly the intercostal spaces, but do not correspond to these in number in consequence of the uppermost space or spaces being supplied by the intercostal branch of the subclavian artery; and in consequence of two sometimes, especially the uppermost, arising by a common trunk: they commonly consist of eight pairs. They arise from the back part of the aorta at a more or less acute angle, the angle becoming more obtuse inferiorly. They pass upwards round the bodies of the vertebræ to the corresponding intercostal spaces; the right arteries from the position of the aorta having the longer course. Near the head of each rib they send a branch backwards, which divides into branches to the muscles lying near the spine, to the spinal marrow, which pass through the vertebral foramina, and to the muscles on the exterior of the chest. They are then continued forwards in the grooves at the under edges of the ribs between the two layers of intercostal muscles, and furnish branches to the intercostal muscles, to the

muscles on the exterior of the chest, abdominal muscles, to the pleura, and to the diaphragm, and form communications with the intercostal branches of the internal mammary, and with branches of the epigastric and external thoracic arteries. The last is, excepting the first, the largest; it passes behind the crus of the diaphragm, and divides upon the quadratus lumborum into branches to this muscle, and to the abdominal parietes: these branches descend as far as the spine of the ilium, and have several communications with the lumbar and circumflex arteries.

§ 4. BRANCHES FROM THE ABDOMINAL PORTION OF THE DESCENDING AORTA.

The branches given off from the aorta during its passage through the abdomen are much more considerable than those which arise from it in the chest. They may be divided into those which arise singly, and those which arise in pairs.

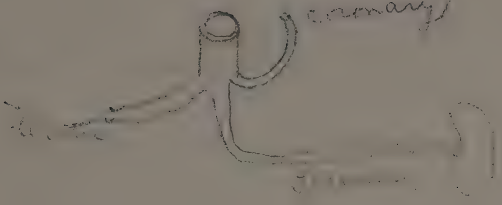
Of those which arise singly, there are three considerable arteries, usually called the three *azygous branches* of the abdominal aorta, the cœliac, the superior mesenteric and the inferior mesenteric. They are distributed entirely to the chylopoietic viscera.

A. Cœliac Artery. *A. Cœliaca.*

Arises from the aorta as soon as it has passed into the abdomen between the crura of the diaphragm, and is placed near the upper edge of the pancreas. It forms a short trunk which soon divides into three branches—the coronary of the stomach, the hepatic, and the splenic.

1. CORONARY OF THE STOMACH, *A. coronaria ventriculi, gastrica superior*, is usually the smallest of the three. It frequently arises in common with one or both diaphragmatic arteries. It takes its course upward and to the left, to the cardia of the stomach, giving off several branches to the œsophagus, cardia, and to the adjacent parts of the stomach. It is then continued along the less curvature of the stomach towards the pylorus, furnishing considerable branches in its course, which descend upon the anterior and posterior surfaces of the stomach for the supply of its coats, and sending small branches to the omentum minus. The coronary frequently gives origin to the left hepatic artery.

2. HEPATIC, *A. hepatica*, is larger than the former. It sometimes arises from the aorta, or in more rare instances from the superior mesenteric: sometimes it arises by two


coronary

& above the Splenic Vein

branches, one of which only is from the coronary or superior mesenteric. It takes its course to the right, then, upwards and forwards, passes through Glisson's capsule to the porta of the liver, a little below which it divides into a right and left hepatic branch. Before its division it gives off

a. RIGHT INFERIOR GASTRIC. *A. gastrica dextra inferior*. It passes downward and to the left between the duodenum, the pylorus, and the pancreas to the greater curvature of the stomach, along which it is continued between the layers of the omentum to the left, and anastomoses with the left inferior gastric branch of the splenic. It furnishes the following branches

α. *Duodenal*, (R. duodenales,) consisting of one or two branches distributed to the duodenum and pylorus.

β. *Pancreatic*, (R. pancreatici,) distributed to the right extremity of the pancreas.

γ. *Epiploic*, (R. epiploici,) long but slender branches, which descend between the layers of the omentum.

δ. *Gastric*, (R. gastrici,) branches which ascend upon the surfaces of the stomach and are distributed to its coats.

b. PYLORIC. *A. pylorica, gastrica dextra superior*. Sometimes given off before the inf. gastric branch, or from that vessel. It descends upon the pylorus, furnishes branches to it and to the adjacent parts, and anastomoses with the coronary upon the lesser curvature of the stomach.

The hepatic artery then terminates in

c. RIGHT HEPATIC. *A. hepatica dextra*. It is larger than the left, supplies the right lobe of the liver, and furnishes the

α. *Cystic Branch*, (A. cystica,) which passes upon the gall-bladder, frequently dividing into two branches, and is distributed to its coats.

d. LEFT HEPATIC. *A. hepatica sinistra*. Supplies the left lobe of the liver.

3. SPLENIC. *A. splenica, lienalis*. Commonly the largest of the branches from the cœliac, takes its course to the left behind the stomach, ~~and~~ along the upper edge of the pancreas, X as far as the fissure of the spleen, opposite to which it divides into several large branches, which are distributed to the substance of the spleen. It furnishes in its course

α. *Pancreatic*, (R. pancreatici,) several in number, which descend inclined to the left upon the pancreas, and send branches into its substance.

β. *Short gastric*, (A. gastricæ breves,) five or six in number, given off where the artery divides, which are distributed upon the left extremity of the stomach, and form numerous communications with the coronary and right gastric branches.

γ. *Left inferior gastric.* (A. gastrica inferior sinistra.) Arises from the same part as the last, but is of larger size. It takes its course along the greater curvature of the stomach, furnishing branches to the coats of the stomach and to the omentum, and anastomoses with the right inferior gastric branch.

B. SUPERIOR MESENTERIC ARTERY. *A. Mesenterica Superior.*

Is generally larger than the cœliac. It arises from the aorta immediately below the cœliac, and sometimes by a trunk in common with it. It is first concealed by the pancreas, behind which it descends, then passes over the duodenum, and takes its course between the layers of the mesentery downwards and to the right, forming a bend of which the concavity is upwards and to the right, and the convexity downwards and to the left, and, gradually diminishing in size, terminates in the right lumbar region. Its first branches are small, distributed to the pancreas and duodenum, and communicate with branches of the hepatic. The principal branches are for the supply of the small and large intestines.

1. BRANCHES TO THE SMALL INTESTINES. *A. intestinales.* They arise from the convexity of the bend, and are ten or eleven in number: those which are towards the middle being the longer. But in size they all decrease from above to below. They take their course between the layers of the mesentery, furnishing small branches both to these and to its glands. They then ramify, and the branches, by uniting, form arches, the convexity of which is towards the intestines. From these, again, branches proceed, which unite and form similar smaller arches, and these again detach numerous yet smaller branches, which likewise freely communicate with each other; so that the distribution of these vessels has the appearance of a network. From the arches nearest the intestines, numerous small branches pass in a straight direction to the anterior and posterior surfaces of the intestines, and are distributed to their coats, in which they freely anastomose with each other.

From the concavity of the bend arise the arteries which supply the large intestines. They are two or three in number, are called the *colic arteries*, (A. colicæ,) and are distinguished as the

2. ILIO-COLIC BRANCH. *A. ilio-colica, colica inferior dextra.* It arises the lowest, and passes downwards, and to the right. It detaches a branch which forms, in part, a communication with that portion of the superior mesenteric which supplies the ilium, and is, in part, distributed to the appendix cæci. It then divides into two branches, one of which descending, supplies the cœcum and adjacent parts of the ilium, the other ascends in the course of the ascending colon, distributing branches to its coats.

3. RIGHT COLIC BRANCH. *A. colica dextra,* the smallest of the three branches. It frequently arises by a trunk in common with the colica media, and sometimes in common with the ilio-colic. It soon divides into two branches, one of which ascends to join with a similar branch of the middle colic, and the other, the larger, descends to join with the ascending branch of the ilio-colic. Both distribute branches to the colon.

4. MIDDLE COLIC BRANCH. *A. colica media, superior dextra.* Arises a few inches from the origin of the trunk of the superior mesenteric, passes towards the middle of the arch of the colon, and divides into two branches, one of which passes to the right, and joins with the ascending branch of the right colic, and the other larger one is continued to the left, and joins with a similar branch of the ascending branch of the inferior mesenteric. Both give off branches to the upper part of the ascending and right portion of the arch of the colon.

c. INFERIOR MESENTERIC ARTERY. *A. Mesenterica Inferior.*

Arises commonly about an inch above the bifurcation of the aorta. It takes its course obliquely downwards and to the left, and divides into branches to the left portion of the colon and to the rectum.

1. LEFT SUPERIOR COLIC. *A. colica sinistra superior, ramus ascendens.* Ascends in the course of the descending colon, and divides into two branches, one of which joins with the left branch of the middle colic, and the other with the ascending branch of the left inferior colic. Both send branches to the arch of the colon and its descending portion.

2. LEFT INFERIOR COLIC. *A. colica inferior sinistra.* Divides like the former into two branches, one of which joins with the descending branch of the left superior colic, and the other with a branch of the internal hæmorrhoidal. They

supply the descending colon and its sigmoid flexure. There is sometimes a third left colic.

3. INTERNAL HÆMORRHOIDAL, *A. hæmorrhoidea interna*, is the continuation of the trunk. It sends off a branch to the left to join (as has been already indicated) with a branch of the left inferior colic, and then descends upon the back part of the rectum, dividing into numerous branches, distributed to its coats, which freely communicate, and anastomose with the other branches distributed to this gut.

The *branches* which arise *in pairs* from the aorta are the diaphragmatic, renal, spermatic, and lumbar.

1. DIAPHRAGMATIC. *A. diaphragmaticæ.* They arise separately, or by a common trunk, from the aorta, as soon as it enters the abdomen, often, and, according to some, most often from the cœliac. Sometimes, however, one only is given off from the cœliac. They pass upward and outward over the crura of the diaphragm, furnishing branches to the crura and glandulæ renales, and then spread into branches upon the under surface of the greater muscle, the middle of which they principally supply, anastomosing with the other branches distributed to the diaphragm.

2. RENAL. *A. renales, emulgentes.* Are branches of large size. They arise from the side of the aorta, usually nearly opposite each other, just below the origin of the superior mesenteric. They pass outwards and a little downwards, over the body of the first or second lumbar vertebra to the sinus of the kidney, opposite to which they divide into three or four branches, which again subdivide, pass into the substance of the kidney, and ramify in the cortical part. They vary frequently in size and in *number*, from one to four on one or both sides, according to the size and situation of the kidney. The right, from the situation of the aorta, is the longer of the two, and passes commonly behind the vena cava inferior. They furnish branches to the ureter, and frequently a larger branch to the renal gland, *A. capsularis,* which besides supplying the renal gland or capsule, furnishes branches to the crus of the diaphragm and lumbar glands.

3. SPERMATIC. *A. spermaticæ, seminales.* They are of small size, but occasionally have a double origin. They arise from the fore part of the aorta, a little below the renal arteries, but often lower, and generally not opposite to each other. Occasionally one arises from the renal, and very rarely from any other artery. They take their course outward and downwards on the psoas muscles, behind the peritonæum and

before the ureters: and the right before the vena cava inferior. In the female they are shorter than in the male, pass between the layers of the broad ligaments, and are distributed to the ovaria, to the fallopian tubes, and the upper part of the uterus, upon which they anastomose with the other uterine arteries. In the male they are continued to the inguinal canal, where they assist in forming the spermatic cord, and in it pass, and are distributed, to the testicle. They furnish branches in their course to the ureters and adjacent parts.

4. LUMBAR. *A. lumbales.* Those from the aorta are commonly four in number on each side, the fifth being usually supplied from the iliac, or from the middle sacral artery. Sometimes there are only three, in consequence of the lowermost arising by a common trunk. They come off more from the back part of the aorta; then take their course backward, round the bodies of the lumbar vertebræ, as far as the roots of the transverse processes, under the psoæ muscles, to which, as well as to the quadrati, they furnish branches. At the roots of the transverse processes each sends a branch backward, (R. dorsalis,) distributed to the muscles lying near the spine, and to the spinal marrow by a branch passing through the vertebral foramina. They are then continued forwards to supply the abdominal muscles, and form communications with branches of the epigastric artery.

§ 5. BRANCHES FROM THE TERMINATION OF THE AORTA.

The aorta commonly terminates upon the fourth, or between the fourth and fifth lumbar vertebræ, by dividing into two large, constant, and corresponding branches, called the common iliac arteries, *A. iliacæ communes, primitivæ;* and a third small azygous, and not constant branch, called the middle sacral, *A. sacra, sacralis media.* These branches supply the lower part of the trunk and lower extremities.

MIDDLE SACRAL. *A. sacralis media.* Is a small branch which arises from the back part of the aorta, at its bifurcation; but is sometimes a branch of the common iliac. It descends over the body of the last lumbar vertebra, thence along the middle of the sacrum and os coccygis, and is lost upon the adjacent parts and back part of the rectum. In its course it gives off commonly a branch on each side to form the fifth lumbar arteries; it next detaches on each false vertebra commonly a pair of branches, which pass outwards, are distributed to the sacrum, send branches through the sacral foramina to the spinal canal, and form communications with the lateral sacral arteries.

Common Iliac Arteries. *A. Iliacæ Communes.*

Come off at an acute angle, and are continued outward and downward over the last lumbar vertebra. The right passes commonly before the left common iliac vein, the left before and to the outer side of the same vein. About opposite to the sacro-iliac symphysis they each terminate by dividing into the *internal* and *external iliac* arteries. The right is commonly a little longer than the left. In their course they furnish only small branches to the adjacent parts.

a. Internal Iliac Artery. *A. Iliaca Interna.*

Passes downwards into the cavity of the pelvis, and soon divides into several branches of various sizes. These vary considerably in their mode of origin; sometimes coming off immediately from the trunk, and sometimes by trunks common to two or more. They supply the contents and parietes of the pelvis, and muscles attached to it; and are the

1. ILIO-LUMBAR. *A. ilio-lumbalis.* Commonly the first branch. It passes transversely outwards under the psoas muscles, and near the sacro-iliac symphysis, and usually divides into two branches: one of which takes its course upwards, and anastomoses with the last lumbar, or takes its place, and furnishes branches which pass through the last vertebral foramen: the other is distributed to the psoas, iliacus and to the ilium, and communicates with the branches of the lumbar and circumflex arteries.

2. LATERAL SACRAL. *A. sacræ laterales.* Generally consists of two or three branches, sometimes furnished by the ilio-lumbar, or gluteal arteries: sometimes formed by a single artery, which then divides into these branches. The lateral sacral arteries furnish *anterior* branches, which pass across the sacrum, distributing branches to it, and inosculate with branches of the middle sacral; and *posterior* branches, which enter the anterior sacral foramina, distribute branches to the cauda equina, and send branches through the posterior foramina to be distributed to the under part of the muscles of the back.

3. OBTURATOR. *A. obturatoria.* Varies considerably with

respect to its origin; most commonly it arises directly from the trunk of the internal iliac, or in common with the ilio-lumbar; but frequently from the external iliac by a trunk of variable length, in common with the epigastric branch of the external iliac; occasionally from the external iliac itself; and still more rarely from the femoral. When it arises from the epigastric, it passes downwards over the body of the os pubis. If it be a branch of the internal iliac, it takes its course forwards, immediately under the brim of the pelvis to the obturator foramen. It is continued through the upper part of the ligamentous expansion which fills up that opening to the upper and inner part of the thigh. In its passage through the pelvis it furnishes branches to the levator ani, and obturator internus muscle, and to the pelvic glands. It divides near the obturator foramen, usually into two branches, one of which distributes twigs to the hip-joint and adjacent muscles, and the other furnishes branches to the obturator externus, and muscles at the inner and upper part of the thigh, and anastomoses with the internal circumflex artery.

4. GLUTEAL. *A glutea, iliaca posterior.* Sometimes arises by a trunk in common with the ischiatic. It sends off in some instances the lateral sacral, the obturator and other branches usually given off from the internal iliac. It passes downwards and outwards through the upper part of the notch of the ilium, furnishing branches to the iliacus and pyriformis muscles, then bends round the edge of the bone, is directed upwards, and divides into two principal branches, the superficial and the deep. The *superficial* passes forwards, between the gluteus maximus and medius, furnishing branches to both, to the pyriformis and to the back part of the sacrum, which anastomose with branches of the lateral sacral. The *deep* passes under the gluteus medius, is distributed to the two lesser glutei, to the parts about the hip-joint, and communicates with branches of the ischiatic and sacral arteries. Some extend as far as the fore part of the thigh, and anastomose with branches of the femoral.

5. ISCHIATIC. *A. ischiatica.* Frequently arises by a trunk, in common with the internal pudic artery, or with the gluteal. It descends inclined forwards from the gluteal artery, passes out of the pelvis below the pyriformis muscle, and is continued in the hollow between the tuberosity of the ischium and trochanter major. Whilst within the pelvis, it detaches branches to the pyriformis, obturator internus, and levator ani muscle. Exterior to the pelvis it sends numerous branches to the gluteus maximus, to parts about the os coccygis, to parts

situated about the back part of the hip-joint, and at the upper and back part of the thigh; and these branches communicate with the circumflex arteries.

6. PUDIC. *A. pudenda interna, communis.* It descends within the pelvis, immediately before the ischiatic artery, and passes out of the pelvis with it before the pyriformis muscle. It then takes its course forwards between the sacro-sciatic ligaments, and re-enters the pelvis. It is continued along the ischium, in the hollow above the tuberosity of that bone, and ascends on the inner side of the ramus of the ischium, and on that of the os pubis, in its course upwards advancing and becoming more superficial, to the under part of the symphysis pubis, where it terminates by dividing into branches, distributed to the organs of generation. This is the usual course, but in some instances in the male, it passes forwards at the under and lateral part of the bladder to the ischium. It furnishes,

α. *Branches* within the pelvis, to the bladder, to the vesiculæ seminales and prostate gland, and, in the female, to the vagina.

β. *Branches* to the muscles and parts adjacent to the sacro-sciatic ligaments, and hip-joint.

γ. *External hæmorrhoidal.* (A. hæmorrhoidea externa.) Consisting of one, sometimes of two branches, distributed to the extremity of the rectum, and to the parts about the anus.

δ. *Perineal.* (A. superficialis perinei.) Passes under the transversus perinei, and is continued forwards between the bulb and crus of the penis, and distributes branches to the skin and muscles of the perineum, and to the scrotum; and in the female to the labia.

ε. *Artery of the bulb.* (A. bulbi urethræ, transversa perinei.) Passes obliquely across the fore part of the perineum, along the transversus perinei muscle; and after furnishing several inconsiderable branches to the adjacent parts, passes into the bulb, and is distributed within the corpus spongiosum.

The trunk of the pudic is then continued as the proper artery of the penis (A. penis) in the male, and as the artery of the clitoris (A. clitoridea) in the female: and under the symphysis pubis it, in both sexes, divides into a superficial and deep branch.

ζ. *Superficial.* (A. dorsalis vel superficialis penis vel clitoridis.) Passes through the suspensory ligament, and takes its course along the dorsum of the penis in a tortuous

direction, as far as the glans. It gives off branches to the skin and ligamentous covering of the penis, and passes into the substance behind the glans.

η. Deep. (A. profunda penis vel clitoridis.) Passes into the crus penis, and is continued forward through the corpus cavernosum, dividing in its course into numerous branches, which freely communicate with those of the opposite side.

7. UMBILICAL. *A. umbilicalis.* In the fœtus it is the continuation of the internal iliac, and is an artery of large size. But after birth it contracts and remains pervious only as far as the bladder. It passes forwards at the side and upper part of the bladder, towards the parietes of the abdomen, and at its beginning sends off one or two branches to the bladder.

8. VESICAL. *A. vesicales.* Consist of one or more branches from the internal iliac, internal pudic, and umbilical arteries, which descend to the under and back part of the bladder, and are distributed to the bladder, to the prostate gland, and vesiculæ seminales in the male, and to the vagina in the female.

9. MIDDLE HÆMORRHOIDAL. *A. hæmorrhoidalis media.* Is sometimes a branch from one of the divisions of the internal iliac, and sometimes is wanting altogether. It supplies branches to the fore part of the rectum, and forms communications with the other hæmorrhoidal branches.

10. VAGINAL. *A. vaginalis.* Is not a constant branch, but is frequently supplied from one of the other pelvic arteries. It is distributed to the vagina and bladder.

11. UTERINE. *A. uterina.* It takes its course to the upper part of the vagina, and detaches one or two branches to the vagina and bladder, then ascends at the side of the uterus, between the layers of the broad ligament. It is tortuous in its course. It divides into branches to the uterus, some of which pass to its appendages; and it anastomoses with branches of the spermatic artery.

b. EXTERNAL ILIAC ARTERY. *A. Iliaca Externa.*

Passes forwards from the internal iliac, takes its course outwards and downwards along the psoæ muscles, accompanied by the corresponding vein, which is situated behind and to its inner side, and covered by the peritonæum. It passes behind Poupart's ligament, and changes its name to that of the *femoral* artery. After furnishing some unimportant branches to the psoas and iliacus muscle, it gives off near Poupart's ligament the epigastric and circumflex arteries.

1. EPIGASTRIC. *A. epigastrica.* It arises commonly from the inner side of the external iliac, immediately above Poupart's ligament; but sometimes higher. It comes off not unfrequently, as has been already described, by a trunk in common with the obturator artery; occasionally from the femoral, and in some rare cases, from the common iliac or deep artery of the thigh. It first passes a little downwards, then bends upwards, and is directed obliquely inwards and upwards towards the back part of the rectus muscle, crossing the spermatic cord or round ligament, and is situated to the inner side of the internal abdominal ring. In an oblique inguinal hernia it is situated to the inner side of the mouth of the sack, and would therefore be endangered by directing an incision, for liberating the stricture, inwards: in a direct inguinal hernia it is placed on the outer side of the mouth of the sack, and might therefore be divided by carrying an incision outward. In a femoral hernia it is situated above and to the outer side, so as not to be easily endangered, except where it arises from the femoral artery; in which case it might be wounded by carrying an incision outwards.

Having reached the back part of the rectus muscle about midway, between the umbilicus and pubes, it then ascends nearly perpendicularly upwards, between the muscle and posterior layer of its sheath; divides commonly into two branches near the umbilicus, detaching branches to the fore part of the abdominal muscles, and terminates above the navel by forming anastomoses with the epigastric branch of the internal mammary, and the lower intercostal arteries. Near the internal ring it sends off—

a. A branch, which after detaching a branch to form a communication with the obturator, passes upon the spermatic cord, or round ligament, and is distributed upon it.

2. CIRCUMFLEX OF THE ILIUM. *A. circumflexa ilii.* Arises commonly nearly opposite to the epigastric, but sometimes a little higher or lower than that artery, from the outer side of the external iliac. It bends upwards and outwards to the spine of the ilium, in the course of which it runs from before to behind, between the transverse and internal oblique muscles. It furnishes branches in its course to the iliacus, sartorius, and broad abdominal muscles, and forms communications with the epigastric and ilio-lumbar arteries. It some-

times detaches a considerable branch, which takes its course inwards and upwards, and is distributed on the fore part of the abdominal parietes.

FEMORAL ARTERY. *A. Femoralis.*

Passes from behind Poupart's ligament, where it commences, and takes its course downwards on the anterior, then on the inner side of the thigh, and at the upper part of the lowest third of the thigh passes through the tendon of the adductor magnus, and receives the name of *popliteal* artery.

The portion of this artery, which is opposite Poupart's ligament, is sometimes distinguished by the name of the *inguinal artery*. (A. inguinalis.) It passes there into the sheath formed by the fascia transversalis and fascia iliaca; it is situated nearly opposite to the junction of the ilium with the os pubis, upon the inner edge of the psoas muscle, with the accompanying vein on the inner side, and the anterior crural nerve on the outer side at a little distance from it, and exterior to the sheath in which the artery is contained.

As it descends it is first situated superficially. *Anteriorly*: it is first covered by the integuments, aponeurosis, inguinal glands, some fat and the fascia lata in the triangular space formed by the crural arch above; by the sartorius on the outer side, and the adductor longus and gracilis muscle on the inner side. Lower, the sartorius, which is gradually inclined towards it, passes obliquely over it, and continues upon it as far as the tendon of the adductor magnus, so as to cover it during its course through the middle third of the thigh. *Posteriorly*, it is opposite to the head of the os femoris, and passes down upon the under end of the psoas and iliacus muscles, and then upon the adductor brevis and magnus muscle, more or less fat and cellular membrane being interposed; but it is close upon the last-named muscle below. On the *outer side*, after quitting the psoas, it is applied to the vastus internus muscle, which separates it below from the os femoris. One branch only of the anterior crural nerve accompanies it, namely the saphænus, situated at the outer and fore part, and more or less involved in its sheath. On the *inner side* it is accompanied by the femoral vein, which, as it descends, is inclined behind the artery, and is applied to the adductor, towards which it passes in its descent.

In the uppermost third of the thigh it is loosely connected to the surrounding parts. In the middle third it is surrounded by muscles, and more closely connected, and is more or less adjacent to the os femoris, so that it may be readily compressed. At the groin likewise, from its vicinity to the bone and from its superficial situation, it admits easily of compression, so that pressure applied about midway between the anterior and superior spinous process of the ilium, and the spinous process of the os pubis, will, by obstructing the artery, command any hæmorrhage from the vessels below.

The branches of the femoral are

1. EXTERNAL EPIGASTRIC. *A. epigastric externa.* Given off close to Poupart's ligament, which ascends on the fore part of the external oblique, under the skin, and is distributed to the superficial parts.

2. EXTERNAL PUDIC. *A. pudicæ externæ.* One or two branches which pass inwards under the skin, and are distributed to the skin of the parts of generation, and adjacent parts. There are, besides, usually several small branches to the skin, muscles, and absorbent glands.

3. DEEP ARTERY OF THE THIGH. *A. profunda femoris.* A branch of large size which comes off from the inner and back part of the femoral artery, usually from one to two inches below Poupart's ligament, but occasionally lower, or sometimes higher and close to it, and in some rare cases above it. It is concealed at its origin by the trunk of the femoral artery. It takes its course downwards and backwards, inclined from the femoral artery, passes between the adductor and vastus internus muscles, and terminates at the back part of the thigh. It gives off the following branches.

a. Internal circumflex. (A. circumflexa interna.) Arises commonly higher than the external, and sometimes from the femoral before the deep artery is given off. It takes its course backwards, between the extremity of the psoas and the pectineus muscles, and bends round the neck of the os femoris. It furnishes branches to the pectinalis, psoas, iliacus, and triceps. It next sends off an ascending branch, which distributes branches to the obturator, and upper part of the triceps muscles, a branch of communication with the obturator artery, and a branch which enters the acetabulum, and supplies the joint. The continuation of the internal circumflex distributes branches to the muscles in the ischiadic region, and to the upper back part of the thigh, and forms anastomoses with branches of the gluteal, ischiatic, and external circumflex arteries: these anastomosing branches are

found much enlarged when the external iliac artery has been tied.*

β. *External Circumflex.* (A. circumflexa externa.) Arises commonly from the outer side of the deep artery nearly opposite the former, but often lower, and more rarely from the femoral. It takes its course outwards under the rectus and over the fore part of the os femoris, and divides into two principal branches. One which is continued in the direction of the trunk bends round the trochanter major, furnishes branches to the gluteus medius principally and adjacent parts, and forms communications with the internal circumflex, gluteal, and ischiatic arteries, which are enlarged after the operation of tying the external iliac artery. The other branch is more considerable. It descends on the posterior surface of the rectus, and divides into branches to the rectus, crureus, and vastus externus muscles, and one commonly descends on the vastus to the knee.

The profunda after detaching the circumflex arteries passes through the adductor magnus and divides into the *rami perforantes;* sometimes it passes down before that muscle and gives off these branches successively, and the arteries then pass through that muscle to the back of the thigh. There are usually two, but sometimes more, occasionally as many as five, perforating branches, distributed chiefly to the muscles at the inner and back part of the thigh.

γ. *First perforant.* (A. perforans prima.) Passes through the triceps a little below the trochanter minor, and commonly divides into two branches. One of which ascends behind the trochanter major, forms communications with the external circumflex, and distributes branches to the gluteus maximus, which communicate with branches of the gluteal. The other branch bends outwards round the thigh bone, and supplies branches to the vastus externus and biceps muscles, and to the bone.

δ. *Second perforant.* (A. perforans secunda magna.) Is larger than the former. It passes backward, and is divided into branches to the flexors of the leg principally and to the adductor and vasti muscles. The perforating branches are subject to considerable varieties. Their branches freely communicate with each other; the upper with branches likewise of the gluteal and circumflex, and the lower with branches of the popliteal and femoral; so that these branches are found considerably enlarged when the trunk* of the femoral artery has been obstructed.

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* See Sir A. Cooper's Account of the anastomoses of the arteries at the groin. (Medico-Chirurg. Transact, vol. iv. p. 425.)

4. MUSCULAR BRANCHES. The femoral artery in the rest of its course after having given off the deep artery furnishes various but inconsiderable branches to the muscles and skin at the inner and fore part of the thigh.

5. ANASTOMOTIC BRANCH. *R. anastomoticus.* Is sent off just before the artery passes through the tendon of the triceps; and takes its course downward and forward upon the vastus internus muscle; upon which it divides into branches, some of which anastomose with the arteries at the upper and inner part of the knee.

POPLITEAL ARTERY. *A. Poplitea.*

Takes its course obliquely downward and outward, and reaching as low as the edge of the popliteus muscle, terminates by dividing into the *anterior* and *posterior tibial* arteries. In the greater part of its course it is deep-seated, owing to the projection of the muscles at the sides which bound the ham. *Posteriorly.* It is covered in the greater part of its course by the popliteal vein and tibial nerve, the latter being the most superficially situated and corresponding to the edge of the semi-membranosus: fat and cellular membrane are interposed between it and the integuments, but it is connected at the upper part of the leg with the gastrocnemii and plantaris. *Anteriorly.* It is only separated from the os femoris, and lower from the capsule of the knee-joint, by fat and cellular membrane, and below it is applied to the popliteus muscle. *On the outer side.* It is first contiguous to the biceps, and is then placed close to the outer head of the gastrocnemius externus. *On the inner side.* It has the semi-membranosus and lower down the inner head of the gastrocnemius externus muscle. In the whole of its course it is embedded in fat, and in a loose cellular structure. Above, it is surrounded by muscles, though only loosely connected with them; and below it is firmly embraced by thick and strong muscles. Although it is placed so near to the thigh bone, it would be with difficulty compressed on account of the projection of the muscles at the

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* See Sir A. Cooper's Account of the dissection of a limb on which the operation for popliteal aneurism had been performed, in the Med. Chir. Trans. vol. ii. p. 251.

sides; and such compression must act first on the tibial nerve. Its branches are

1. SMALL BRANCHES to the flexors of the leg.

2. SUPERIOR OUTER ARTICULAR. *A. articularis superior externa.* It bends outwards and forwards round the os femoris, above its outer condyle, between it and the biceps flexor cruris to the vastus externus. It furnishes branches to the biceps, the interior of the knee-joint, and to the vastus externus; and its branches anastomose with those of the opposite upper articular, those of the lower articular on the same side, and with the descending branch of the external circumflex artery.

3. SUPERIOR INNER ARTICULAR. *A. articularis superior interna.* It sometimes arises by a trunk in common with the former, and generally higher; but in some instances from the femoral artery, in which case it descends along the edge of the vastus internus. It bends inwards, and forwards round the os femoris, above the inner condyle, between it and the semimembranosus and semi-tendinosus muscles, and the tendon of the adductor magnus, and ramifies to the adjacent muscles, and to the knee-joint, by branches which form communications with the superior outer and inferior inner articular arteries, and with the anastomosing branch of the femoral artery.

4. MIDDLE ARTICULAR. *A. articularis media, azyga.* Is frequently a branch of one of the superior articular. It passes downwards between the condyles, and is continued to the knee-joint, to which it is principally distributed, anastomosing with branches of the other articular arteries.

5. INFERIOR OUTER ARTICULAR. *A. articularis inferior externa.* Comes off nearly opposite to the joint, passes downwards and outwards and then forwards between the external lateral ligament and the capsule of the joint. It furnishes branches to the gastrocnemius externus and knee-joint, and ramifies at the under and fore part of the knee, forming communications with the upper outer, and inferior inner, articular arteries.

6. INFERIOR INNER ARTICULAR. *A. articularis inferior interna.* Comes off near the former, and descends inward, and then forward immediately under the head of the tibia, covered by the inner head of the gastrocnemius. It furnishes branches to the joint and popliteus muscle, and is spread into branches at the under and fore part of the knee,

which anastomose with the opposite lower articular, and with the upper articular on the same side.

7. SURALES, OR BRANCHES TO THE GASTROCNEMIUS MUSCLE. *A. surales.* Arise from the back part of the artery above the inferior articular. They are commonly two in number, whence they have been sometimes called, *gemellæ;* and are distributed to the heads of the gastrocnemius externus and plantaris muscles.

8. There are usually several other, but small and unimportant branches, from the popliteal artery.

ANTERIOR TIBIAL ARTERY. *A. Tibialis Antica.*

Sometimes comes off higher than the part before described. It passes forward through the upper part of the interosseous ligament, and then descends on the anterior surface of that ligament, first between the tibialis anticus and extensor longus digitorum muscles, and, lower, between the former muscle and the extensor proprius pollicis, accompanied by a branch of the peroneal nerve, situated on its fore part, and by the accompanying veins. During this part of its course, it is deep-seated, separated from the skin by the projection of the muscles at the sides, and by the aponeurosis of the leg. At the lower part of the leg it takes its course upon the fore part of the tibia, is crossed by the extensor longus pollicis, and becomes more superficial. It is continued then behind the annular ligament to the upper and inner part of the foot, along which it proceeds as the artery of the foot, (A. pedis,) between the tendon of the extensor longus pollicis, and the inner tendon of the extensor longus digitorum, to the space between the metatarsal bones of the first and second toe, and there divides into a dorsal branch of the great toe and the deep anastomotic branch. The artery of the foot is sometimes continued from the posterior tibial or peroneal artery. The branches of the anterior tibial are

1. ANTERIOR RECURRENT. *A. recurrens anterior.* Arises after the artery has passed through the interosseous ligament. It takes its course upward upon the anterior surface of the head of the tibia, distributes branches to the tibialis anticus, and fore part of the knee-joint, and forms communications with the inferior articular arteries.

2. MUSCULAR. Numerous but small branches which pass

off laterally to supply the muscles and skin at the fore part of the leg.

3. MALLEOLAR. *A. malleolaris externa et interna.* Two small branches given off near the under end of the tibia, but variable as to size and origin, distributed to the parts about the inner and outer ankle.

4. TARSAL. *A. tarsea,* Arises from the outer side of the artery near the ankle-joint: sometimes of considerable size. It passes obliquely outwards, furnishes branches to the tarsus, to the outer side of the ankle-joint, and to the muscles and skin on the upper and outer part of the foot; with some, which pass along the outer side of the foot to the little toe: and it forms communications with branches of the fibular, malleolar, and plantar arteries.

5. METATARSAL. *A. metatarsea.* Arises from the outer side of the artery, but varies somewhat as to origin. It is directed obliquely outwards under the extensor brevis digitorum, and forms several communications on the outer side of the foot with the tarsal and other branches of the foot. In its course it sends off,

a. Interosseal branches. (A. interosseæ dorsales.) Generally four in number, which pass forwards in all the interspaces of the metatarsal bones, except the first; giving off branches to the interossei muscles, and then continued each by two branches upon the lesser toes. (A digitales dorsales.)

6. BRANCHES which are distributed to the upper and inner part of the foot.

7. DORSAL OF THE GREAT TOE. *A. dorsalis pollicis.* One of the two into which the artery divides in the space between the metatarsal bones of the first and second toes. It passes forwards to the great toe, and sends a branch to the second.

8. DEEP ANASTOMOTIC BRANCH. *R. anastomoticus profundus.* The other division passes between the first and second metatarsal bone to the sole of the foot, and joins with the plantar arch.

After the origin of the anterior tibial, the Posterior Tibial descends, covered by the gastrocnemii, for about an inch, and divides into two branches, one of which retains the name of the common trunk and the other called the peroneal artery.

PERONEAL ARTERY. *A. Peronea.*

Compared with the posterior tibial, it is commonly the less of the two, but varies in size. It sometimes arises higher, and not unfrequently lower; and in some instances is wanting altogether. It takes its course down the leg along the inner side of the fibula, between the superficial and deep layer of muscles, situated at first upon the tibialis posticus, then at the edge of the flexor longus pollicis; below becomes covered by the last-named muscle, and terminates by dividing into an anterior and posterior branch. It sends off,

1. MUSCULAR BRANCHES. Distributed to the gastrocnemii, tibialis posticus and flexor longus pollicis, muscles.

2. BRANCH TO THE FIBULA. Forming a medullary artery.

3. ANTERIOR. *A. peronea anterior.* Varies in size, passes through the lower part of the interosseous ligament, and is continued before the outer malleolus upon the foot, dividing into branches, distributed to the adjacent muscles, and anastomosing with branches of the anterior tibial artery. It is sometimes a branch of the posterior tibial, and sometimes is altogether wanting: occasionally it is a branch of large size, and forms the artery of the foot, in which case the anterior tibial is unusually small, and terminates by joining with it.

4. POSTERIOR. *A. peronea posterior.* Descends behind the outer malleolus, distributing branches to the adjacent parts, and terminates on the outer side of the foot, forming anastomoses with the malleolar and tarsal branches of the anterior tibial artery. In some rare instances this branch is of large size, and instead of passing behind the outer ankle bends inwards to the hollow of the os calcis, and divides into the inner and outer plantar arteries.

POSTERIOR TIBIAL ARTERY. *A. Tibialis Postica.*

Is larger than the former. It bends inwards after its origin, and descends through the leg behind the tibia, between the superficial and deep layer of muscles; and after passing behind the inner malleolus, terminates at the sinuosity of the os calcis, between it and the origin of the abductor pollicis, by dividing into the *inner* and *outer plantar* arteries. In its course it is deep seated above, and passes over the tibialis posticus and between it, and the flexor longus digitorum muscles, covered

by the soleus. At the lower part of the leg it is more superficial, situated between the edge of the tendo Achillis and malleolus internus; it has at that part the tendons of the tibialis posticus and flexor longus digitorum muscles on the inner or tibial side, and the tendon of the flexor longus pollicis on the outer or fibular side, and is covered by a strong aponeurosis. The tibial nerve is situated to its outer or fibular edge, and the accompanying veins on the sides at the upper part of the leg, but opposite the base of the tibia it is crossed by the inner plantar nerve, so that from that point till it divides into the plantar arteries, it has the plantar nerves on the inner and outer side. It gives off

1. BRANCHES TO THE MUSCLES, and principally to the deep-seated. They are given off during the course of the artery through the leg; but are not considerable either in number or size.

2. NUTRITIOUS OF THE TIBIA. *A. nutritia tibiæ.* A branch of considerable size given off from the upper part of the artery. It descends, and, after giving twigs to the periosteum, enters the foramen at the back part of the tibia.

3. BRANCHES, two or three in number, distributed to parts about the inner ankle, heel, and to the muscles of the great toe, which form several communications with branches of the anterior tibial artery.

PLANTAR ARTERIES. *A. Plantares.*

1. INNER PLANTAR. *A. plantaris interna.* Is the smaller of the two. It passes forwards on the inner side of the sole of the foot. It follows the course of the abductor and flexor brevis pollicis, to the head of the metatarsal bone of the great toe, between them and the aponeurosis plantaris. It furnishes

Branches to the muscles of the great toe in the inner plantar region, to the tarsal joints, and branches of communication with branches of the anterior tibial.

The trunk then generally bends inwards, and between the first and second toe joins with the plantar digital branch of the great toe.

2. OUTER PLANTAR. *A. plantaris externa.* Is larger and more deep-seated than the former. It takes its course obliquely outwards between the flexor brevis and flexor accessorius digitorum, to the inner edge of the abductor

minimi digiti, along which it runs to the base of the metatarsal bone of the least toe; it then bends inwards, and is continued between the arch of the metatarsus and the adductor pollicis as far as the metatarsal bone of the great toe, where it anastomoses with the deep branch of the anterior tibial, forming the plantar arch, *arcus plantaris*. It furnishes

Branches to the muscles of the middle and plantar regions, and forms anastomoses on the outer side of the foot with branches of the anterior tibial and peroneal arteries.

3. PLANTAR ARCH. *Arcus Plantaris.*

α. *Branch* to the least toe, (A. digitalis plantaris digiti quinti,) which passes along its outer side, as far as its extremity, distributing inconsiderable branches in its course.

β. *Plantar digital branches*. (A. digitales plantares.) Generally three in number, which come off from the fore part of the arch, pass forwards to the interstices of the toes, namely, to those of the second and third, third and fourth, and fourth and fifth, and divide each into two branches, one of which passes along the outer side of one toe, and the other along the inner side of the adjacent toe. They are continued as far as their extremities, where they anastomose, furnishing small branches in their course, partly distributed to the toes, and partly communicating with the dorsal branches.

γ. *Plantar digital branches* of the great toe, and inner side of the toe next to it, present very frequent varieties. Most commonly they come off by a branch detached from the deep branch of the anterior tibial, where it joins with the plantar arch, which then sends one branch along the inner side of the great toe, and one to the interstice between the great toe and toe next to it, and divides into a branch to each. Sometimes they are supplied by the inner plantar, and sometimes entirely by the plantar arch.

δ. *Perforating*. (A. perforantes.) Small branches from the fore and upper part of the arch to the interossei and transverse muscles, and metatarsus, which send branches between the metatarsal bones to anastomose with branches of the anterior tibial on the dorsum of the foot.

§ 6. TABLE OF THE ARTERIES.

1. From the Arch of the Aorta.

1. The unnamed trunk, dividing into—
   Right common carotid.
   Right subclavian.
2. Left common carotid.
3. Left subclavian.

The common carotid divides into—*a.* External Carotid, *b.* Internal Carotid.

a. External Carotid. Its branches are

1. Superior Thyroideal, giving off—
   - *α.* Muscular branches.
   - *β.* Laryngeal.
   - *γ.* Thyroid.

2. Lingual, giving off—
   - *α.* Muscular branches.
   - *β.* Hyoideal.
   - *γ.* Dorsal of the tongue.
   - *δ.* Sublingual.
   - *ε.* Ranine.

3. Facial, giving off—
   - *α.* Inferior palatine.
   - *β.* Glandular.
   - *γ.* Submental.
   - *δ.* Branches to lips, cheek, &c.
   - *ε.* Inferior coronary.
   - *ζ.* Superior coronary.
   - *η.* Branches to nose, corner of the forehead, &c.

4. Ascending Pharyngeal.

5. Occipital, giving off—
   - *α.* Branches to muscles and glands about angle of jaw.
   - *β.* Descending branch.
   - *γ.* Branch to dura mater.
   - *δ.* Branches to the exterior of the cranium.

6. Posterior Aural, giving off—
   - *α.* Branches to parotid gland and muscles.

- β. Stylo-mastoid.
- γ. Branches to ear and side of head.

7. TEMPORAL, giving off—
   - α. Branches to parotid gland.
   - β. Branches to the masseter muscle.
   - γ. Transverse of the face.
   - δ. Deep temporal.
   - ε. Anterior auricular.
   - ζ. Temporo-frontal.
   - η. Temporo-occipital.

8. INTERNAL MAXILLARY, giving off—
   - α. Spheno-Spinal.
   - β. Inferior maxillary.
   - γ. Temporal.
   - δ. Masseterine.
   - ε. Buccal.
   - ζ. Pterygoideal.
   - η. Alveolar.
   - θ. Infra-orbitar.
   - ι. Descending palatine.
   - κ. Lateral nasal.

b. INTERNAL CAROTID. Its branches are

1. OPTHALMIC, giving off—
   - α. Lachrymal.
   - β. Central of the retina.
   - γ. Ciliary.
   - δ. Muscular.
   - ε. Ethmoidal.
   - ζ. Supra-orbitar.
   - η. Internal-angular.

2. COMMUNICATING (with the basilary.)

3. ANTERIOR OF CEREBRUM, giving off—
   - Transverse.
   - Artery of corpus callosum.

4. MIDDLE OF CEREBRUM.

5. TO CHOROID PLEXUS.

SUBCLAVIAN ARTERY. Its branches are

of the

1. VERTEBRAL; giving off—
    - α. Branches to muscles and spinal marrow.
    - β. Posterior artery and spinal marrow.
    - γ. Inferior artery of the cerebellum.
    - δ. Anterior artery of the spinal marrow.

The vertebral arteries unite to form the

BASILAR ARTERY; giving off—
- α. Branches to pons varolii, &c.
- β. Internal auditory.
- γ. Superior artery of the cerebellum.
- δ. Posterior artery of the cerebrum.

The other branches of the Subclavian artery are

2. Inferior thyroideal.
3. Supra-scapular.
4. Ascending cervical.
5. Superficial cervical.
6. Deep cervical.
7. Internal mammary, giving off—

    - α. Thymic.
    - β. Pericardiac.
    - γ. Mediastinal.
    - δ. Branch accompanying phrenic nerve.
    - ε. Intercostal.
    - ζ. Phrenic.
    - η. Epigastric.

8. Superior intercostal.

AXILLARY ARTERY; its branches are

1. Superior thoracic.
2. Humeral thoracic.
3. Long thoracic.
4. Alar thoracic.
5. Infra scapular, giving off—

    - α. Internal scapular.
    - β. Inferior dorsal of the scapula.

6. Anterior circumflex.
7. Posterior circumflex.

BRACHIAL ARTERY; its branches are

1. Deep humeral, giving off—
   - α. Communicating radial.
   - β. Branches to triceps.
2. Inferior deep humeral.
3. Muscular branches.
4. Anastomotic branch.

RADIAL ARTERY; its branches are

1. Recurrent radial.
2. Muscular branches.
3. Superficial palmar.
4. Branches to the wrist.
5. Dorsal.
6. Large artery of the thumb.
7. Radial of the fore finger.
8. Deep palmar, which forms the deep palmar arch.

ULNAR ARTERY; its branches are

1. Recurrent ulnar.
2. Interosseal, giving off—
   - α. Posterior interosseal.
   - β. Anterior interosseal.
3. Muscular branches.
4. Dorsal.
5. Deep ulnar.

It then forms the superficial palmar arch, which gives off the

6. Digital branches, consisting of:
   - α. Branch to the inner side of the little finger.
   - β. Branch to interstice of ring and little finger.
   - γ. Branch to interstice of ring and middle finger.
   - δ. Branch to interstice of middle and fore finger.

II. BRANCHES FROM THE THORACIC PORTION OF THE AORTA DESCENDENS:

1. Bronchial.
2. Œsophageal.
3. Mediastinal.
4. Intercostal, eight or nine pair.

III. BRANCHES FROM THE ABDOMINAL PORTION OF THE AORTA DESCENDENS:

I. CŒLIAC divides into

- 1. CORONARY OF THE STOMACH.
- 2. HEPATIC; its branches are
  - 1. Right inferior gastric, giving off—
    - α. Duodenal.
    - β. Pancreatic.
    - γ. Epiploic.
    - δ. Gastric.
  - 2. Pyloric.
  - 3. Right hepatic, giving off—
    - α. Cystic.
  - 4. Left hepatic.
- 3. SPLENIC; its branches are
  - α. Pancreatic.
  - β. Short gastric.
  - γ. Left inferior gastric.
  - δ. Splenic.

2. SUPERIOR MESENTERIC; its branches are

- 1. Branches from its convexity to small intestines.
- 2. Ilio-colic.
- 3. Right colic.
- 4. Middle colic.

3. INFERIOR MESENTERIC; its branches are

- 1. Left superior colic.
- 2. Left inferior colic.
- 3. Internal hæmorrhoidal.

- 1. DIAPHRAGMATIC.
- 2. RENAL.
- 3. SPERMATIC.
- 4. LUMBAR (four pair.)

4. BRANCHES FROM THE TERMINATION OF THE AORTA:

- 1. MIDDLE SACRAL.
- 2. COMMON ILIAC, divides into—

External iliac.
Internal iliac.

INTERNAL ILIAC; its branches are

1. Ilio-lumbar.
2. Lateral sacral.
3. Obturator.
4. Gluteal, divides into—
    - α. Superficial branch.
    - β. Deep branch.
5. Ischiatic.
6. Pudic, giving off—
    - α. Branches to parts about the neck of the bladder.
    - β. Branches to parts about the outlet of the pelvis.
    - γ. External hæmorrhoidal.
    - δ. Perineal.
    - ε. Artery of the bulb.
    - ζ. Superficial of the penis.
    - η. Deep of the penis.
7. Umbilical.
8. Vesical.
9. Middle hæmorrhoidal.
10. Vaginal.
11. Uterine.

EXTERNAL ILIAC ARTERY; its branches are

1. Epigastric, giving off—
    - α. Branch to spermatic cord, or round ligament.
2. Circumflex of the ilium.

FEMORAL ARTERY; its branches are

1. External epigastric.
2. External pudic.
3. Deep artery of the thigh; giving off—
    - α. Internal circumflex.
    - β. External circumflex.
    - γ. Perforating { First perforant. Second perforant.
4. Muscular branches.
5. Anastomotic branch.

POPLITEAL ARTERY; its branches are

1. Branches to flexor muscles of the leg.
2. Superior outer articular.
3. Superior inner articular.
4. Middle articular.
5. Inferior outer articular.
6. Inferior inner articular.
7. Surales.
8. Small branches.

ANTERIOR TIBIAL ARTERY; its branches are

1. Anterior recurrent.
2. Muscular.
3. Malleolar.
4. Tarsal.
5. Metatarsal, giving off—
    - *a.* Interosseal.
6. Dorsal of the great toe.
7. Deep anastomotic.

PERONEAL ARTERY; its branches are

1. Muscular.
2. Medullary of the fibula.
3. Anterior.
4. Posterior.

POSTERIOR TIBIAL ARTERY; its branches are

1. Muscular.
2. Nutritious of the tibia.
3. Branches to ankle, heel, &c.

INNER PLANTAR ARTERY; its branches are—

To the muscles of the great toe and tarsal-joint.

OUTER PLANTAR ARTERY; its branches are

1. Muscular.

It forms the PLANTAR ARCH, which gives off—

1. Branch to the little toe.
2. Digital branches, consisting of—
    - *α.* Branch to the interstice of the 4th and 5th toe.
    - *β.* Branch to the interstice of the 3d and 4th toe.
    - *γ.* Branch to the interstice of the 3d and 2d toe.
3. Plantar digital branches of the great and 2d toe.
4. Perforating.

CHAPTER III.

Of the Veins.

In the following account of the distribution of the veins, these vessels are described like the arteries, from trunk to branch, therefore contrary to the course of the blood which flows through them. By so doing, the description is rendered more simple; for as the greater number of veins accompany the arteries, it will be only necessary to refer to the particulars of the course of the corresponding arteries in order to explain the distribution of the accompanying veins. There are, however, some veins which do not take the course of the corresponding arteries, and there are others to which there are no corresponding arteries; it will be therefore requisite to particularize the course and distribution of these two sets of vessels.

The vena portæ and its branches, and the vessels which return the blood from the brain, have been described in the account of the viscera to which they belong.

Seven Primitive Veins are usually described, viz. those which pour their contents immediately into the heart—vena cava superior, vena cava inferior, coronary vein, and the four pulmonary veins; of these the pulmonary and coronary veins have been treated of with the lungs and heart. The veins, therefore, the course and distribution of which remain to be spoken of, and which furnish the branches accompanying, and returning the blood from the ramifications of the aortic system, are the vena cava superior, and inferior.

§ 1. VENA CAVA SUPERIOR.

The Superior Cava furnishes the branches which supply the head, neck, upper extremity, and parietes of the chest. It arises from the upper and right part of the right auricle, ascends as high as the cartilage of the first rib, and a little above the curvature of the aorta divides into two considerable trunks, called the subclavian veins. In its course it is sur-

rounded for about two inches by the pericardium: it has *to the left* the aorta, *to the right,* the right lung; *behind,* the right superior pulmonary vein; and *before,* the cartilages of the uppermost ribs.

Occasionally the subclavian veins do not unite, but pass separately to the auricle. In this case the left takes its course downwards before the aorta, passes round the outer and back part of the left auricle, and being continued in the fossa at the under surface of the heart terminates behind and below in the right auricle.

After the vena cava superior has quitted the pericardium, it gives off the—

I. Azygous Vein. *Vena Azygos, sine pari.* It bends backward, between the œsophagus and pleura, to the vertebral column, along which, and situated on the fore part of the vertebræ and to the right of the aorta, it descends through the chest. It passes then from that artery, either through the aperture for the aorta or through the lesser muscle of the diaphragm, upon the first lumbar vertebra, and terminates by anastomosing with the inferior cava, with the first lumbar or with the renal veins. It gives off the

α. *Right bronchial vein,* (V. bronchialis dextra,) which comes off near the origin of the azygous, and accompanies the bronchia on the same side.

β. *Œsophageal,* (V. œsophageæ,) small branches to the œsophagus.

γ. *Right inferior intercostal.* (V. intercostales inferiores dextræ.) They come off from the right and back part of the azygous vein at various angles, and accompany the intercostal arteries. They are ten or eleven in number; but frequently two or more are furnished by a single trunk.

δ. *Left azygous.* (V. azygos sinistra, hemiazygos.) Comes off about the seventh or eighth dorsal vertebra. It descends inclined to the left behind the aorta, upon the vertebræ, quits the chest with the aorta, or passes through the appendix of the diaphragm, and terminates, like the azygous vein, on the right side. It sends off in its course the five or six inferior intercostal veins on the left side.

Such is the ordinary distribution of this vein, but it is subject to considerable varieties.

II. & III. Subclavian Veins. *V. Subclaviæ.* These veins, after their origin from the cava, pass obliquely upwards and outwards, quit the chest, above the first rib bend outwards, and are continued before the scaleni antici muscles, which separate them from the corresponding arteries. Having passed the clavicle, they change their name to that of *axillary* veins.

In consequence of the situation of the superior cava to the right, these Subclavian Veins, between their origin and the scaleni, differ considerably on the right and left sides. The *left* is nearly twice the length of the right: its direction is nearly horizontal, or but slightly oblique: it takes its course immediately before and above the arch of the aorta, and behind the upper edge of the sternum to the left. The *right*, on the contrary, has nearly a vertical direction. Both are placed to the outer side of the sternum, behind the cartilage of the first rib, the sternal extremity of the clavicle, and the muscles attached to these parts. The branches which the Subclavian veins furnish are six large, viz.—Superior intercostal—Internal mammary—Inferior thyroideal—Vertebral—External jugular—Internal jugular; and some branches of less importance to the diaphragm, the thymus gland, and the pericardium.

1. SUPERIOR INTERCOSTAL. *V. intercostalis suprema.* From the lower and back part of the subclavian. The right divides into branches to the two uppermost intercostal spaces. The left is considerably larger than the right, and is sometimes a branch of the vertebral; it divides into branches which accompany the intercostal arteries on the left side as far as the seventh or eighth intercostal space, and anastomoses with branches of the azygous vein. It gives off also the

a. Left bronchial vein, which is distributed like the right.

2. INTERNAL MAMMARY. *V. mammaria interna.* It accompanies, and corresponds with the artery of the same name.

3. INFERIOR THYROIDEAL. *V. thyroidea inferior.* The right arises nearer to the extremity of the subclavian on the same side, than the left, and sometimes takes its origin from the superior cava itself. It passes upwards and inwards, and divides into branches which form anastomoses with branches of the opposite vein, and are distributed to the thyroid gland, and adjacent parts. The ramification of these branches about the trachæa has been called the thyroideal plexus.

4. VERTEBRAL. *Vena vertebralis.* Arises from the back part of the subclavian. It passes obliquely upward and backward, takes its course to the foramen in the transverse process of the seventh cervical vertebra, and is continued with the vertebral artery, before which it is placed, through the transverse processes of the vertebræ above. It usually gives

Internal Jugular Vein tyed by Simmons
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off a branch below, which sometimes arises separately, passes through the transverse process of the seventh cervical vertebra, and joins with the trunk. The vertebral vein in its course gives off branches, which pass between the muscles and other branches that communicate through the vertebral foramina with the vertebral sinus. It terminates by branches to the muscles under the occiput, and sometimes one branch passes through the posterior condyloid foramen to communicate with the lateral sinus.

5. EXTERNAL JUGULAR. *V. jugularis externa.* It arises on the outer side of the internal jugular, sometimes by two branches which soon unite. It passes upward from behind the clavicle behind the sterno-mastoid muscle, embedded in cellular membrane towards the edge of that muscle; is continued upon the sterno-mastoid, becoming more superficial, and covered only by the platysma myoides and skin: after which it crosses obliquely the upper part of the muscle, and is continued to the angle of the lower jaw. Here it sometimes terminates by an anastomotic branch with the internal jugular vein; but sometimes it is of large size, and accompanies the external carotid artery through the parotid gland, and near the neck of the lower jaw divides into the internal maxillary and temporal veins. These veins again divide, and are distributed like the arteries of the same name. It gives off

α. *Branches* behind the sterno-mastoid, which accompany the scapular and posterior cervical branches of the subclavian artery.

β. *Sub-cutaneous branches* to the neck.

γ. *Posterior aural vein;* which is distributed with the artery of the same name.

δ. *Anastomotic branch.* A short but considerable branch, which passes deep under the parotid gland, and forms a communication with the internal jugular vein.

6. INTERNAL JUGULAR. *V. jugularis interna.* Is a vein of considerable size. It furnishes most of the branches of the cranium and face. It comes off from the subclavian vein, nearly opposite to the extremity of the clavicle; then ascends nearly vertically in the neck, as high as the lacerated foramen of the base of the skull. In its course it is situated to the outer side of the carotid artery, which it in part covers, and likewise the pneumo-gastric nerve. It has otherwise the same relative position as the carotid. At the lower part of the neck it forms a considerable sinus or enlargement.

At the upper part of the larynx it gives off the SUPERIOR THYROIDEAL, the FACIAL, the LINGUAL, the PHARYNGEAL and

OCCIPITAL veins. These veins take the course of the corresponding arteries, and are distributed in the same way with little variety.

At the lacerated openings of the base of the skull, the internal jugular vein receives the lateral sinus on each side, so that it returns the blood which has circulated through the brain, and of which the lateral sinuses are reservoirs from the other sinuses and returning vessels of the brain. For their description, see p. 150.

AXILLARY VEIN. *V. Axillaris.*

Furnishes the veins which are distributed to the upper extremity. These are divided into—1. Superficial, 2. Deep-seated. The deep-seated take the course of the arteries of the same name, and the greater number of the arteries are accompanied each by two veins. The axillary vein receives that name after having passed the clavicle. It passes obliquely downwards and outwards in the axilla, situated *before* the corresponding artery, but having otherwise the same relative position. Having reached the lower edge of the tendon of the latissimus dorsi, it changes its name to that of *brachial* vein.

It gives off in its course the EXTERNAL THORACIC, INFRA SCAPULAR, and ARTICULAR VEINS, which are distributed like the arteries of the same name. Besides these it furnishes two considerable veins, which form the superficial or cutaneous veins of the upper extremity, viz. the cephalic and basilic.

1. CEPHALIC. *V. cephalica.* It arises from the axillary, immediately after it has passed the clavicle. It takes its course outward, between the large pectoral and deltoid muscles, then descends between these muscles, and is continued upon the fore and outer part of the upper arm, along the outer side of the biceps flexor cubiti, as far as the bend of the elbow, giving off in its course some small branches. At the bend of the elbow it divides into two branches, the cephalic median and superficial radial.

α. *Cephalic median.* (V. mediana cephalica.) Generally of considerable size, which passes obliquely downwards and inwards, and joins below with the basilic median vein.

β. *Superficial radial.* (V. radialis cutanea.) Which descends on the outer part of the fore arm. It commonly divides into two branches, one of which takes its course

more on the fore part of the arm, and sometimes into several branches. These furnish numerous branches which are continued obliquely to the back of the hand, and contribute to form there a considerable plexus. One of the principal branches is found in the space between the metacarpal bones of the thumb and fore finger, and is frequently distinguished by the name of the cephalic of the thumb. (V. cephalica pollicis.)

2. BASILIC. *V. basilica.* Larger than the cephalic. It arises from the axillary vein, usually just before it becomes brachial, and is at this part deep-seated. It descends on the inner side of the arm in the course of the ulnar nerve, which it conceals, and gives off a few branches only. A little above the inner condyle of the os humeri it divides into two branches, the basilic median and superficial ulnar.

α. Basilic median. (V. mediana basilica.) Descends obliquely outwards, and unites at an acute angle commonly with the cephalic median. From this junction arise usually two branches, a deep branch and the common median.

β. The *deep* branch passes deep-seated between the muscles, forming an anastomosis with the deep-seated veins.

γ. Common median. (V. mediana communis.) It passes down on the anterior surface of the fore arm, is continued obliquely outwards, and divides into branches, the greater number of which pass round the radius to join with the superficial radial veins. The branches of this vein sometimes supply the place of the superficial radial.

δ. Superficial ulnar. (V. ulnaris superficialis cutanea.) It commonly divides into two branches, an anterior and a posterior, the latter of which is the more considerable. They descend on the inner side of the fore arm, are inclined towards the back of the hand, and divide into numerous branches which freely communicate with the branches of the superficial radial, and assist them in forming a considerable plexus. One branch which is placed between the ring finger and little finger has been distinguished by the name of (V. salvatella.)

BRACHIAL VEIN. *Vena Brachialis.*

It is frequently double, or, if single, divides in its course into two branches, which accompany the brachial artery during the rest of its course. Where the artery divides, each of the veins gives off two branches, which take the course of the radial and ulnar arteries, and furnish branches that accompany the divisions of those vessels, so that each branch of an artery is accompanied by two veins.

§ 2. VENA CAVA INFERIOR.

The Inferior Cava furnishes the ramifications which accompany the distribution of the aortic system in the lower part of the trunk and lower extremities. This vein is of larger size than the superior cava; it arises from the outer and back of the right auricle, and extends from that part to the fourth or fifth lumbar vertebra. After its origin, it is directed a little outwards, and passes through the aperture in the tendon of the diaphragm; this takes place so immediately after its origin, that the pericardium is attached only to a very small portion of the vessel. Having entered the abdomen, it continues its course, forming a slight bend to the right, deep-seated in the depression and sometimes in a complete canal, at the posterior edge of the liver. Below the liver, it descends upon the right crus of the diaphragm on the right side of the bodies of the lumbar vertebræ, and on the right of the aorta: at the fourth or fifth lumbar vertebra it terminates, by dividing into the two *common iliac* veins. The inferior cava sometimes divides into two branches, which again unite; the additional vessel however varying in size and length. The branches which the inferior cava gives off during its course are:—the Diaphragmatic, Hepatic, Renal, Capsular, Spermatic, and Lumbar.—These accompany the arteries of the same name, and are distributed like them. The Left Renal Vein, however, is longer than the right, and commonly passes before the aorta to its destination. The left lumbar veins also, which pass behind the aorta, are longer than the right. The left spermatic vein comes off from the left renal vein.

Hepatic Veins.

Usually consist of two or three large, and numerous small veins; the former coming off from the cava opposite to the convex surface of the liver, so soon as that vein has entered the abdomen, and the latter behind the liver. They pass into and ramify within the substance of the liver.

Middle Sacral Vein.

Comes off from the extremity of the inferior cava, and

frequently from the left common iliac vein. It accompanies the artery of the same name.

COMMON ILIAC VEIN. *Vena Iliaca Communis, Primitiva.*

It passes downward and outward, forming with the opposite vein an obtuse angle, and about opposite to the sacro-iliac symphysis divides into *external* and *internal iliac* vein. In consequence of the cava dividing below and to the right of the aorta, the right common iliac artery crosses over the origins of both common iliac veins. The common iliac veins are situated behind and a little to the inner side of the arteries which they accompany.

1. INTERNAL ILIAC VEIN. *V. Iliaca Interna, Hypogastrica.*

It descends into the pelvis, behind the artery which it accompanies. Its branches are of considerable size, and correspond in number, name, and distribution, with the branches of the internal iliac artery. Their ramifications within the pelvis are very considerable, and form a sort of plexus surrounding each of the viscera, viz. the bladder and the rectum, and in the female the vagina.

2. EXTERNAL ILIAC VEIN. *V. Iliaca Externa.*

It accompanies the artery of the same name, and is situated behind and to the inner side of that vessel. It passes with it under Poupart's ligament, and there changes its name to that of the *femoral* vein. It gives off the EPIGASTRIC and CIRCUMFLEX ILIAC VEINS, which are distributed with the corresponding arteries.

FEMORAL VEIN. *V. femoralis.*

It supplies the lower extremity with a deep-seated and superficial set of veins, like those already described in the upper extremity. The femoral vein descends through the thigh with the femoral artery: it is situated at Poupart's ligament, and in the upper part of the thigh to the inner side of the artery, but in its course is gradually inclined behind that vessel. It passes with it through the tendon of the adductor magnus, and on entering the ham takes the name of the *popliteal* vein. In its course the femoral gives off branches, which accompany the deep artery of the thigh and its ramifications, and the other branches of the femoral artery. It furnishes besides a considerable subcutaneous branch, called the

SAPHÆNA. *V. saphæna major.* It arises from the femoral, a little below Poupart's ligament, and passes through the opening of the fascia of the thigh. It descends then between the aponeurosis and skin along the inner side of the thigh; detaching some branches to the parts of generation, some which ascend between the skin and muscles of the abdomen, and a branch which passes down a little before it and distributes branches to the fore part of the thigh; this branch anastomoses with the saphæna near the inner condyle, or is continued sometimes down the leg. The saphæna is continued from the thigh behind the inner condyle, takes its course obliquely along the inner and fore part of the leg, passes then before the inner malleolus upon the dorsum of the foot, and spreads into branches, which reach as far as the toes, and form, by anastomosing, an intricate plexus.

POPLITEAL VEIN. *V. poplitea.*

Descends behind the popliteal artery, and after furnishing branches which accompany the divisions of that artery, divides into ANTERIOR and POSTERIOR TIBIAL VEINS: and, as in the upper extremity, each artery is accompanied by two veins, which accompany, and are distributed like, the corresponding arteries. It gives off also the second subcutaneous branch: the

LESSER SAPHÆNA. *V. saphæna minor.* Arises in the hollow of the ham. It descends nearly vertically with the communicating tibial nerve, and descends between the gastrocnemius and skin in the depression between the heads of that muscle; then continues its course along the edge of the tendo Achillis, passes behind the outer malleolus, and divides into numerous branches, which extend along the upper and outer part of the foot, and anastomose with branches of the saphæna major.

CHAPTER IV.

Of the Absorbents.

The Absorbent System consists of *glands* and *vessels.* In the following description we have adopted the method of first describing the glands, and afterwards the distribution of the vessels in the different divisions of the body. The absorbent vessels accompany for the most part the ramifications of the blood-vessels, especially those of the veins; and, therefore, a reference to these will in most instances indicate the distribution of the former. From the number of absorbent vessels, it would be both difficult and unprofitable to trace them singly, and they will, therefore, be described in sets. The main trunks and termination of the absorbents, formed by the thoracic duct and the trunk of termination on the right side, will be first spoken of; and afterwards, the glands and vessels of the head and neck, of the upper extremity, of the lower extremity, and of the trunk and viscera, will be successively described. The absorbent vessels take their course in almost all parts of the body, in a *superficial* and more numerous set, and in a *deep-seated* set, accompanying the arteries.

We have not adopted the division of the absorbents into lacteal and lymphatic vessels, as the distinction seems to have no real foundation nor practical utility.

§ 1. TRUNKS OF THE ABSORBENT VESSELS.

All the absorbent vessels of the body terminate in two trunks, which pour their contents into the venous system at two points; namely, at the junction of the internal jugular and subclavian veins on each side. By far the greater number terminate in the trunk on the left side, called the *thoracic duct.* It receives the absorbents of the left half of the head and neck, of the left upper extremity, of both lower extremities, of the left half of the chest and its contents, and of the viscera of the abdomen, except some from the liver. Therefore, those which terminate in the trunk on the right side, are those only of the right half of the head and neck, of the right upper extremity, of the right half of the parietes and contents of the thorax, and of a part of the liver.

1. LEFT TRUNK. *Ductus thoracicus sinister.*

Begins between the crura of the diaphragm, upon the first or second lumbar vertebra, or sometimes as high as the twelfth dorsal vertebra, being formed by the junction of the absorbents of the lower extremities and of those of the abdominal viscera. The latter sometimes terminate by several trunks; but it is formed, in most instances, by three trunks, of which the middle trunk receives the absorbents from the viscera, and the two others those of the lower extremities. Near, or at the part where these trunks unite, is formed the receptacle of the chyle, *receptaculum, cysterna chyli,* which is situated between the aorta and the right crus of the diaphragm. In many instances, this is truly an enlargement of the under extremity of the duct of an oval or pyriform figure; but frequently the appearance is found to be produced by the conglomeration of the numerous tortuous absorbent trunks, forming the thoracic duct, and intimately connected and covered by a dense cellular structure. The thoracic duct then passes behind and to the right of the aorta, between the crura of the diaphragm into the chest. It is at first placed upon the fore and right side of the vertebræ, and takes its course upward, between the aorta and vena azygos. In its ascent it bends over to the left side, commonly about the fourth or fifth dorsal vertebra, behind the œsophagus, and continues its course behind the arch of the aorta, on the inner and back part of the left subclavian artery, and through the upper opening of the chest, as high as the upper edge of the last cervical vertebra. It then makes a turn downwards and inwards, and terminates in the upper and back part of the angle formed by the left internal jugular and left subclavian vein, or occasionally in one only of these veins.

About the middle of the chest it is usually somewhat contracted, but enlarges again superiorly. It is commonly more or less tortuous in its course, and most frequently divides into two or more collateral branches, which again unite, or sometimes terminate separately. Occasionally it is found to divide into two branches, about the middle of the chest, one of which only terminates on the left, whilst the other passes to the right side of the neck.

2. RIGHT TRUNK. *Ductus thoracicus dexter.*

It is much smaller than the left, and is seldom more than half an inch in length. It is formed by the absorbent vessels of the upper and right part of the body, as has been already

mentioned; and terminates in the angle formed by the right internal jugular and right subclavian vein, in some instances in one only of these vessels. Occasionally it is found wanting, in which case the absorbent trunks which otherwise form it, enter the veins separately at that part.

§ 2. ABSORBENT GLANDS AND VESSELS OF THE HEAD AND NECK.

1. Glands of the Head and Neck.

a. Glands of the Head. Their number and size are inconsiderable. Their existence in the interior of the cranium has not been clearly ascertained. They are distinct on the external surface of the head, but are more numerous on the face than on the cranium.—*a.* On the cranium, there are two or three small glands placed behind the ear.—*β.* On the face: there are more numerous glands, situated, some superficially upon the parotid gland, some deep-seated upon the buccinator muscle, and some behind the parotid gland. Those most constantly found, are glands situated along the under edge of the lower jaw upon the anterior belly of the digastricus muscle.

β. Glands of the Neck. There are some few of small size but not always distinct, which are placed superficially in the course of the external jugular vein. The deeper seated glands are more considerable, both in size and number; there are one or two near the larynx, and some few at the back part of the neck, but the most considerable are situated at the sides of the neck, (Glandulæ concatenatæ, jugulares) and are more numerous than any other set of glands in the body, excepting those of the mesentery. They form a chain in the course of the carotid artery and the internal jugular vein, covered by the sterno-mastoid muscle, from the mastoid process to the upper part of the chest. They are most numerous near the division of the trunks of the blood-vessels. There are also smaller glands situated in the space between the sterno-mastoid and trapezius muscle and the clavicle.

2. Absorbent Vessels of the Head and Neck.

1. Superficial Absorbents of the Head.

a. Superficial Absorbents of the Cranium. Unite to form an uncertain number of trunks. The anterior, three or four in number, accompany the temporal vessels, and enter some of the glands situated under the zygoma. The posterior, which are not more numerous, descend in the course of the occipital artery, pass through the small glands behind the ear, and unite with the superficial absorbents of the neck.

β. Superficial Absorbents of the Face. Are more numerous than the above; accompany the blood-vessels. Some pass through the glands on the buccinator muscle, but the greater number through the glands at the under edge of the lower jaw, and the glands at the upper part of the neck. And, at this part, the superficial absorbents of the cranium and face join with the deep vessels of the head, and are continued by three or four trunks, which accompany the internal and external jugular veins.

2. Deep-seated of the Head.

α. Deep-seated of the Cranium.—They have only been found on the membranes of the brain, but have never been traced into its substance. Their trunks pass out of the cranium with the blood-vessels, and unite with the superficial absorbent vessels of the head and neck.

β. Deep-seated of the Face. Arise from the muscles and cavities of the nose and mouth. Their trunks accompany the blood-vessels, and enter the upper cervical glands.

All the trunks of the superficial and deep-seated absorbents of the head and neck pass through the cervical glands, freely communicate with each other, and with absorbents from the chest and upper extremity. They unite to form one or more trunks, which terminate in the upper part of the thoracic duct, at the angle formed by the internal jugular and subclavian veins, or in one of these veins.

§ 3. ABSORBENT GLANDS AND VESSELS OF THE UPPER EXTREMITY.

1. Glands of the Upper Extremity.—There are seldom any found below the elbow-joint.

α. Glands at the Elbow. There are commonly two or three small glands anteriorly, near the inner condyle. Between the condyle and the cavity of the axilla five or six glands are commonly found on the inner and fore part of the upper arm, in the course of the humeral artery.

β. Axillary Glands. The number and size of these are much more considerable than the above-mentioned, being sometimes as many as twelve in number. They surround the trunks of the blood-vessels, and are situated prin-

cipally between the serratus magnus, pectoralis minor, and the trunks of the axillary vessels, to which they closely adhere, but extend under the pectoralis major and clavicle.

2. Absorbent Vessels of the Upper Extremity. The superficial absorbents of the trunk are considered with these, as they all terminate in the axillary glands.

1. Superficial Absorbents.

a. Of the back of the Trunk. The superficial absorbents of the whole surface of the back, from the neck to the loins, terminate in the axillary glands. The greater number of these pass upon the trapezius muscle, and are continued through it into the axilla.

β. Of the Side and Fore Part of the Trunk. The upper pass over the pectoralis major, and bend over its under edge to the axilla. The lower pass over the serratus magnus and obliquus externus abdominis to the axillary glands. Some of these penetrate the parietes of the chest, and join with absorbents in its interior.

γ. Of the Upper Extremity. They arise from the fore and back parts of the fingers and hand.—Those of the back part ascend upon the fore arm, forming a considerable and freely communicating plexus: they separate then into two sets; one of which passes obliquely over the muscles on the radius, and the other over those on the ulna, to the fore and inner part of the fore arm, so that near the elbow-joint they all are situated anteriorly. Those of the anterior part of the hand unite, to form three or four trunks, which ascend on the fore arm, and unite near the elbow with the posterior set. Most of the absorbents pass through the glands at the elbow, and, on the inner side of the upper arm, unite into fewer trunks, and terminate in the axillary glands. A few of the absorbents accompany the cephalic vein; and, after passing between the deltoid and larger pectoral muscles, terminate also in the axillary glands.

2. Deep-seated Absorbents.

These are much fewer in number. Two commonly accompany each principal artery in the fore arm, and these are united into trunks, which ascend with the brachial artery. They communicate freely with the superficial set, and terminate in the axillary glands.

The above-described absorbent vessels of the upper extremity and surface of the trunk, which pass through the axillary glands, unite to form four or five trunks, which surround the subclavian vein. Where this vessel enters the chest these again unite to form two or three larger trunks, which ascend behind the subclavius muscle, and over the subclavian artery, and terminate either separately or after having joined with the deep-seated absorbents and head, on the right side in the right trunk, and on the left side in the thoracic duct.

§ 4. ABSORBENT GLANDS AND VESSELS OF THE LOWER EXTREMITY.

1. Glands of the Lower Extremity. These are rarely found below the knee, one has been, however, occasionally noticed upon the upper end of the interosseous ligament connecting the tibia with the fibula.

α. *Popliteal glands.* Are small in size, and their number rarely exceeds three or four. They are deep-seated in the fat and cellular membrane, which surrounds the popliteal vessels.

β. *Inguinal glands.* These, except the mesenteric, are the largest glands in the body. Some of these are situated superficially, and others deep-seated. They vary in size; and in number from eight to sixteen, but there are generally about twelve. The superficial are placed between the skin and fascia of the thigh, and the greater number of these close together about the termination of the saphæna major, whilst other are situated lower on the fore part of the thigh. The deep-seated are less numerous; they are placed under the fascia, and close to the femoral vessels.

γ. *External iliac glands.* Are six or eight in number. They are placed in the course of the iliac vessels from Poupart's ligaments to the lumbar glands.

δ. *Internal iliac glands.* Vary in number, but are in general more numerous than the external. They are situated about the branches of the internal iliac vessels.

ε. *Sacral glands.* Are placed between the sacrum and rectum.

2. Absorbent Vessels of the Lower Extremity. With these are described as in the upper extremity some of the absorbents of the trunk, and in addition those of the external parts of the organs of generation.

1. Superficial Absorbents.

α. *Of the under part of the trunk.* These arise from the under and fore part of the abdomen, from the loins, buttocks, and perineum. They form communications with

each other, and with the superficial absorbents of the lower extremity, and terminate in the inguinal glands.

β. *Of the external parts of the organs of generation.* In the male they arise from the scrotum and penis; in the female from the clitoris and labia. Those of the penis and clitoris take their course along the dorsum and side of these parts in two or three trunks. They form various anastomoses at the upper part of the thigh and terminate in the inguinal glands.

γ. *Of the lower extremity.* They arise by an anterior and posterior set. The anterior set is formed by absorbents which arise from the upper part of the toes and foot, upon which they form a considerable plexus: the branches from these take their course upwards along the fore and inner part of the leg, to the inner part of the knee. The posterior set is formed by vessels which arise principally from the sole of the foot, and ascend on the posterior surface, but most of them during their course pass obliquely over the fore and back part of the leg to join with the anterior set. From the branches of both sets larger trunks are formed, consisting of about twelve or fourteen vessels which ascend on the fore and inner part of the thigh, and terminate at the groin in the superficial inguinal glands. The superficial absorbents of the thigh take the same course, those from the back part passing round to join with the former, and terminate also in the inguinal glands.

2. Deep-seated Absorbents.

They are much less numerous than the former, and accompany the blood-vessels. In the leg one or two trunks are found accompanying each of the arteries, and arising from the parts to which the arteries are distributed. They pass with these to the ham, and there terminate in the popliteal glands. From these glands three or four larger trunks accompany the popliteal and then take the course of the femoral artery, and receiving in their ascent some vessels, which accompany the deep arteries, terminate in the inguinal glands. Some of the deep-seated absorbents of the thigh accompany the ischiatic and obturator arteries and terminate in glands situated in the pelvis.

§ 5. ABSORBENT GLANDS AND VESSELS OF THE ABDOMEN.

1. Glands of the Abdomen. Are more numerous than those of any part of the body. They are situated principally

in the doublings of the peritonæum, and may be divided into the mesentric, ventricular, cœliac, and lumbar.

α. *Mesenteric.* Are the most considerable both in size and number. Those of the small intestines are larger and more numerous than those belonging to the large intestines, and those corresponding to the jejunum exceed in both respects those of the other small intestines. There are generally about a hundred, but they vary in number, and many more have been sometimes counted. They are situated between the layers of the mesentery, and none nearer than from one to two inches from the intestines; they increase in size, and are placed more closely together towards the root of the mesentery. The glands of the large intestines are rarely more than thirty, and sometimes, not more than twenty, in number ; the greater number are found between the layers of the transverse meso-colon. They are situated nearer to the intestines than the former.

β. *Ventricular.* Are situated along the greater and lesser curvature of the stomach; but they are of small size and few, seldom exceeding four or five in number.

γ. *Cœliac.* Are the glands situated about the vena portæ and the divisions of the cœliac and superior mesenteric artery. They vary in number.

δ. *Lumbar.* Are large and numerous. They surround the aorta and vena cava, and are situated on the fore part of the sides of the lumbar vertebræ.

2. ABSORBENT VESSELS OF THE ABDOMEN.

1. OF THE PARIETES OF THE ABDOMEN. The anterior accompany the epigastric artery, the lateral pass along the crista of the ilium, and both terminate in the external iliac glands. The posterior pass to the lumbar glands; and those of the parietes of the pelvis are continued to the internal and external iliac and to the lumbar glands.

2. OF THE VISCERA OF THE ABDOMEN. They may be divided into those of the *urinary* and *generative* organs, and those of the *chylopoietic viscera.*

A. OF THE URINARY AND GENERATIVE ORGANS. The superficial absorbents have been already described.

α. *Of the kidney.* The superficial arise from the external surface, pass towards the sinus, and after forming several trunks, join with the deep-seated. The deep-seated arise from the interior, take their course with the vessels to the sinus, and together with the superficial terminate in the lumbar glands.

β. *Of the renal capsule.* Unite partly with those of the kidney, and in part with those of the digestive organs at the upper part of the abdomen.

γ. *Of the ureters.* Join with those of the urinary bladder and kidneys, and terminate in the iliac and lumbar glands.

δ. *Of the urinary bladder.* Form a considerable plexus on its parietes; are continued to the internal iliac glands.

ε. *Of the penis and clitoris.* The deep-seated absorbents of the penis and clitoris, pass with the blood-vessels into the pelvis, and terminate in the pelvic glands.

ζ. *Of the testicle.* They are numerous and of large size; they form eight or ten trunks, which pass up in the spermatic cord, follow the course of the spermatic blood-vessels, and terminate in the lumbar glands.

η. *Of the prostate gland and vesiculæ seminales.* They join with those of the bladder.

θ. *Of the vagina and uterus.* Those of the vagina and lower part of the uterus terminate in the iliac glands, except some which arise from the orifice of the vagina, and accompany the round ligament through the abdominal ring. Those of the upper and larger part of the uterus are joined by those of the ovaria, accompany the spermatic vessels, and terminate in the lumbar glands.

B. ABSORBENT VESSELS OF THE CHYLOPOIETIC VISCERA. They are distinguished into those of the intestines, stomach, omenta, liver, spleen, and pancreas. Those of the intestines are frequently called lacteals, from the milk-like fluid which they convey during the digestive process, but do not differ in fact from the absorbents at other parts of the body.

α. *Of the intestines.* Those of the small are much more numerous than those of the large intestines; and of the small those of the duodenum and jejunum are in greater number than those of the ilium. The superficial arise from the peritonæal and muscular coats; they run lengthwise on the intestines, and freely anastomose. The deep-seated arise from the villous coat, and form the orifices which absorb the chyle. They pass transversely on the intestinal canal, which they surround, and anastomose freely with the superficial set. Both sets unite to form trunks, which run between the layers of the mesentery, with the blood-vessels, and pass through the mesenteric glands. In their course they join into fewer but larger trunks, and near the pancreas unite with the absorbents of that gland, and of the spleen and liver, to form one of the large roots of the thoracic duct. The absorbents of the descending colon and rectum terminate in the lumbar and sacral glands.

β. Of the stomach and omenta. In the stomach may be distinguished a superficial and a deep-seated set. They follow the course of the principal blood-vessels of the stomach. Those of the left extremity pass with the short arteries, and join with the absorbents of the spleen. Those of the upper part arise from the upper part of the stomach; they pass to the left along the less curvature, and through the small glands of that part; then unite near the cardia, are continued to the right and join with the absorbent trunks from the liver. Those of the under part are formed by branches from the under part of both the surfaces of the stomach, and from the omentum; they accompany the blood-vessels along the greater curvature of the stomach, and pass through the glands which are found in that situation: they take their course behind the pancreas in the neighbourhood of the cœliac and superior mesenteric arteries, and there join with the trunk of the absorbents of the intestines.

γ. Of the spleen and pancreas. The superficial of the spleen arise from its surface, and pass from its convex to its concave surface. The deep-seated arise in its substance, and pass out at the sinus, where they are joined by the superficial. Both sets then accompany the splenic vessels to the right, and join with the other absorbent trunks of the digestive organs.

Those of the pancreas join with the absorbents of the spleen and stomach.

δ. Of the liver. The superficial absorbents of the upper surface are distributed into three or more sets, which have each a different course of termination. One set is formed by branches from the middle both of the right and left lobe, and consists of six or seven trunks, which ascend between the layers of the suspensory ligament, and pass into the chest between the diaphragm and ensiform cartilage: they are continued through the anterior mediastinum, receiving in their course absorbents from the diaphragm, pericardium, and thymus gland, and terminate commonly in the left trunk, but sometimes in the right, or both. Some of the absorbents of this set occasionally terminate in the thoracic duct before it has quitted the abdomen. The second set is formed by branches from the right lobe, the trunks, of which it is composed, ascend upon the right lateral ligament, pass through the diaphragm, are continued upon its convex surface near the ribs, and terminate in the trunks of the first set: some

branches, like those of the former, terminate in the thoracic duct. The third set is formed by branches from the left lobe, its trunks pass to the left lateral ligament, join with absorbents from the stomach, and terminate in the thoracic duct before it has quitted the abdomen.

The superficial absorbents of the under surface are less numerous; those of the right and left lobe usually unite to form one set. They all anastomose with the superficial of the upper surface, and with the deep-seated, and form trunks which are collected in the porta, descend with the hepatic vessels, and join with the absorbent trunks of the intestines.

The deep-seated absorbents accompany the blood-vessels and biliary ducts, are collected into trunks which pass out at the porta of the liver, join with the superficial of the under surface of the liver, with those of the stomach, spleen, and pancreas, and unite at the root of the mesentery with the absorbents of the intestines to form the middle root of the thoracic duct.

§ 6. ABSORBENT GLANDS, AND VESSELS OF THE CHEST.

1. Glands of the Chest. They consist of those of the parietes, of the mediastinum, and of the lungs.

α. *Glands of the parietes.* They are small and irregular, both in number and situation. The greater number are placed between the layers of the intercostal muscles, and at the sides of the vertebræ on the heads of the ribs. There are some few in the course of the internal mammary artery.

β. *Glands of the mediastinum.* Those of the posterior mediastinum are small, but often numerous. They are situated in the course of the aorta and œsophagus. Those of the anterior mediastinum are about eight or ten in number, and are situated upon the anterior surface of the pericardium.

γ. *Bronchial glands.* They are situated about the divisions of the bronchia, and are found to extend with their branches into the substance of the lungs. Their size and number are considerable. The largest are placed between the divisions of the trachæa. At an early period of life they are of a reddish colour; in the adult they assume a brownish hue, and as age advances become black.

2. Absorbent Vessels of the Chest. They consist of

those of the parietes and of the organs contained within the chest.

a. Of the parietes. Those of the sides consist of branches from all the parts which form the parietes of the chest. They unite into trunks, which accompany the blood-vessels in the intercostal spaces, and join at the side of the vertebral column with branches from the spinal canal, and from the muscles of the back. They pass through the glands at the side of the spine, and terminate in the thoracic duct. Those of the fore part arise from the upper part of the abdominal muscles and diaphragm, are united into trunks which take their course at the sides of the posterior surface of the sternum, pass through the glands, which are there situated, receive in their course branches from the intercostal spaces, and form one or two trunks which ascend before the left subclavian vein. Those of the right side terminate in the right trunk or separately in the subclavian or jugular vein. Those of the left side terminate in the left trunk.

β. Of the lungs. The superficial arise from all parts of their surface, and form a complicated network or plexus upon their lobes. They form trunks which pass to the inner surface, and terminate in the bronchial glands. The deep-seated arise from the substance of the lungs, anastomose freely with the superficial, are united into trunks, which accompany the ramifications of the air-tube and blood-vessels, and terminate in the bronchial glands. The vessels which pass off from the bronchial glands form two or three trunks, which ascend behind the internal jugular vein, and terminate on the right side in the right trunk, and on the left in the left trunk of the absorbents.

The trunks above described receive the absorbents of the pericardium and thymus gland, which ascend in the anterior mediastinum, where they pass through some small glands.

γ. Of the heart. The absorbents of the heart accompany its vessels, ascend upon the aorta and pulmonary artery, and pass through several small glands in their course. They unite with the absorbents of the lungs, thymus gland, and anterior mediastinum, and terminate in the left trunk of the absorbents, or separately in the subclavian and jugular vein.

CHAPTER V.

Of the Nerves.

The Nerves are divided into three classes:—1. The cerebral nerves, or those which arise from the brain:—2. The spinal nerves, or those which arise from the spinal cord; and 3. The sympathetic nerves. They consist collectively, including the sympathetic, of forty-three pairs. Different anatomists have adopted different modes of enumeration and of classification. These differences have principally arisen from considering as portions of nerves some which have been here numbered as distinct, increasing the number of spinal nerves by those which take their origin from the medulla oblongata, or increasing that of the cerebral nerves by those which are here considered as originating from the spinal cord, or lastly from not distinguishing the sympathetic as a peculiar pair or system of nerves. In the following description we consider

The Cerebral Nerves to consist of eleven pairs, viz.

1. Olfactory.
2. Optic.
3. Common oculo-muscular.
4. Inner oculo-muscular.
5. Trigeminal.
6. Outer oculo-muscular.
7. Auditory.
8. Facial.
9. Glosso-pharyngeal.
10. Pneumo-gastric.
11. Lingual.

The Spinal Nerves are described as consisting of thirty-one pairs, viz.

One Accessory.
One Sub-occipital.
Seven Cervical.
Twelve Dorsal.
Five Lumbar.
Five Sacral.

And The Sympathetic, forming one pair, and completing the number of forty-three pairs of original nerves.

§ 1. CEREBRAL NERVES.

For the origin of these nerves, see the description of the Brain, p. 162.

I. Olfactory. *N. olfactorius, par primum.* It passes forwards, and a little inwards, from the under and back part of the anterior lobes of the cerebrum, in a fossa upon their under surface, to the crybriform plate of the ethmoid bone; and gradually enlarging, here forms an oval bulb. From the under surface of the bulb numerous filaments arise, which pass through the perforations of the crybriform plate: these filaments divide into two sets, one passing on to the septum, the other upon the ossa turbinata; and being continued between the membrane and bone, are distributed to the membrane of the nose.

II. Optic. *N. opticus, par secundum.* Is the largest of the cerebral nerves. It passes down from the back part of the thalamus, and is continued forwards and inwards over the under surface of the crus cerebri, with which it is connected. It is at first flattened, but becomes in its course gradually rounded; and upon the under surface of the floor of the third ventricle, joins with the opposite nerve. With respect to the mode of this junction, see p. 163. It then separates from the other optic nerve, and takes its course forward and outward; passes through the foramen opticum, and after penetrating the sclerotic and choroid coats of the eye, spreads out to form the Retina.

III. Common Oculo-muscular. *N. oculo-muscularis communis, motor oculi, par tertium.* It comes off from the under surface of the cerebrum, on the inside of the crus cerebri, where adjacent to the edge of the pons Varolii. It passes forward and outward, perforates the dura mater at the side of the posterior clinoid process, takes its course along the upper part of the cavernous sinus, enters the orbit through the lacerated foramen of the orbit, and immediately divides into branches.

1. *Branch* to the levator oculi, which detaches a twig or two to the levator palpebræ superioris.
2. *Branch* to the adductor oculi.
3. *Branch* to the depressor oculi.

× and as it is continued forward sinks to the inner side of the opthalmic branch of the fifth which completely covers it &

X to the edge of the for: lac: orbit: sup:, just behind which it ascends over the third pair and passing to the inner side of the supraorbital

+ & to the outer side of the 4th pair,

4. *Branch,* the longest and slenderest, to the inferior oblique; with which commonly passes off the—

5. *Branch* to the lenticular ganglion.

IV. Inner Oculo-muscular. *N. oculo-muscularis internus, superior, patheticus, par quartum.* Is the smallest of the cerebral nerves. From its origin behind the corpora quadrigemina it takes its course downwards and turns round the crus cerebri; then passes forwards through the dura mater near the posterior clinoid process, continues along the cavernous sinus below the third pair, and enters the orbit ~~through the foramen lacerum.~~ It goes obliquely forwards and inwards immediately under the upper part of the orbit, and penetrates the superior oblique muscle, to which it is entirely distributed.

V. Trigeminal. *N. trigeminus, par quintum.* Is a nerve of considerable size. It comes off from the brain at the under surface of that part of the crus cerebelli, which extends from the pons Varolii, and is there distinctly fasciculated. It passes forwards towards the upper edge of the petrous portion of the temporal bone, and is continued under the dura mater upon the surface of the petrous portion. It here forms close on the outside of the cavernous sinus, the Semilunar Ganglion or Plexus, *ganglion semilunare, plexus gangliformis,* an enlargement of a semilunar form, with its concave edge placed backwards and upwards, and its convexity downwards and forwards, in which the numerous fibrillæ, of which the nerve is composed, are interwoven with each other. From the anterior part of the plexus three principal nerves are formed:—1. Ophthalmic—2. Superior maxillary—3. Inferior maxillary.

(1.) FIRST BRANCH OF the FIFTH PAIR, OPHTHALMIC. (Ramus primus, N. ophthalmicus.)

Is the smallest; it takes its course forward along the outer and under part of the cavernous sinus, is connected with the fourth pair, and passes into the orbit through the lacerated opening. Commonly just before its entrance into the orbit it divides into two or three branches, viz.

1. *Supra orbitar.* (N. supra orbitaris, frontalis.) The most considerable branch. It passes above the origins of all the muscles of the eye, is continued forwards between the lining membrane of the orbit and the levator palpebræ superioris, under the orbitar process of the frontal bone; is continued upward through the foramen supra orbitare, or in the notch when the foramen is not distinct, and is distributed to the skin of the fore and upper part of the head. It detaches in the orbit:

a. Branch, (N. supra-trochlearis,) which takes its course more on the inner side, and is distributed to the upper eyelid and forehead.

β. Branch which passes to the frontal sinuses, but not always found.

2. *Nasal.* (R. nasalis, naso-ocularis.) Takes its course inwards between the optic nerve, and the levator oculi muscle, then between the superior oblique and adductor oculi, along the inner side of the orbit to the inner corner of the eye, and is divided into branches to the lachrymal sack and caruncle, and to the parts about the inner canthus. It sends off:—

α. A branch near its commencement to the lenticular ganglion.

The OPHTHALMIC OR LENTICULAR GANGLION is of small size. It is situated on the outside of the optic nerve, surrounded by fat and cellular membrane. From this ganglion pass the Ciliary Nerves, *N. ciliares,* about twelve or fourteen small filaments, several of which frequently come off from the nasal nerve. The ciliary nerves run along the optic nerve, penetrate the sclerotic coat, pass upon the choroid, detaching some small twigs to it, and are principally distributed to the iris.

β. Ethmoidal, (N. ethmoidalis,) which passes through the foramen orbitare internum anterius, into the cranium, descends through one of the anterior openings of the crybriform plate of the ethmoid bone into the nose, and continues its course along the fore part of the septum to the point of the nose, distributing branches to the membrane at the fore part of the nose.

3. *Lachrymal.* Directs its course along the abductor oculi on the upper and outer part of the orbit, and divides anteriorly into branches to the lachrymal gland, and to the adjacent parts of the eyelid and cheek. One branch forms a connection with one of the branches of the second division of the fifth pair.

(2.) SECOND BRANCH OF THE FIFTH PAIR, SUPERIOR MAXILLARY. (R. secundus, N. maxillaris superior.) Passes forwards and issues from the cranium through the foramen rotundum of the sphenoid bone, and is lodged at a space left between the bones behind the orbit, where it divides into branches.

1. *Malar,* (N. subcutaneus malæ,) which passes through a foramen in the malar bone, furnishing small twigs, in its passage to the adjacent parts, and is distributed upon the cheek.

2. *Alveolar.* (N. alveolaris, dentalis.) It passes down upon the posterior surface of the tuberosity of the supe-

× Is best seen by carefully dividing the abductor oculi

rior maxilla, and divides into branches distributed to the cheek and buccinator muscle, and other branches which pass through small canals in the bone to the membrane lining the antrum, and to the molar teeth of the upper jaw.

3. *Spheno-palatine.* (N. spheno-palatini, nasales laterales.) They sometimes come off immediately from the trunk: but sometimes the trunk first divides into two or three branches which are then again united by a gangliform enlargement called the SPHENO-PALATINE GANGLION. *G. Meckelii,* from which these branches together with the palatine and pterygoid branches are given off. The spheno-palatine nerve soon divides into three or four considerable branches, which pass inwards through the spheno-palatine foramen, into the nose, and are distributed to the membrane of the posterior ethmoidal cells, sphenoidal sinus, Eustachian tube, outer and back part of the side of the nose, and of the back part of the septum. One branch after passing over the septum is continued through the foramen incisivum to the roof of the mouth; and sometimes forms a GANGLION, *G. naso-palatinum,* described by Cloquet.

4. *Pterygoid.* (N. pterygoideus, vidianus, anastomoticus.) Comes off from the spheno-palatine ganglion, or by a trunk in common with the spheno-palatine nerve. It directs its course backward through the pterygoid canal or foramen, and in it divides into two branches:—

a. Superficial, (N. petrosus superficialis,) which passes into the skull through the cartilaginous and membranous substance, which fills up the foramen lacerum basis cranii anterius, is continued backwards in the canalis innominatus, and passing through the foramen innominatum it enters the stylo-mastoid canal, and joins with the facial nerve.

β. Deep. (N. profundus.) After issuing from the pterygoid canal, passes backwards into the carotid canal, and there joins with the branches which form the communication between the sympathetic, and the fifth and sixth nerves of the brain.

5. *Palatine.* (N. palatinus, palato-maxillaris.) Descends in the fossa between the pterygoid process of the sphenoid bone and the palatine bone, and divides usually into three branches. The largest of the three descends through the pterygo-palatine canal, furnishing some branches to the membrane at the back part of the nose, and after passing inferiorly through the palato maxillary foramen, is continued upon the under surface of the bony palate; upon which it divides into three or four considerable branches, which take their course between the bone and membrane at the root of the alveolar process, and are distributed to the membrane of

the mouth and gums. The two or three smaller, after passing some way in the canal with the larger, descend through separate bony passages, and are distributed to the tonsil, velum palati, and the pillars of the fauces.

6. *Infra-orbitar.* (N. infra-orbitaris.) Appears like the continuation of the nerve itself. It is directed forwards, and takes its course through the infra-orbitar canal. Within the canal it gives off branches, which, passing through passages in the upper jaw, are distributed to the membrane of the nose, and to the incisor, cuspidati, and the bicuspides teeth of the upper jaw. It then passes through the infra-orbitar foramen, and immediately divides into a number of considerable branches, distributed to the skin and muscles of the cheek, to the under eyelid, to the nose, and to the upper lip.

(3.) THIRD BRANCH OF THE FIFTH PAIR. INFERIOR MAXILLARY. (R. tertius, maxillaris superior.) The largest of the three branches from the semilunar ganglion. It passes downward and forwards, quits the cranium through the foramen ovale, and becomes covered by the pterygoideus externus muscle. It then divides into branches distributed to the muscles of the lower jaw, which sometimes come off by a single trunk, and to the tongue and the lower jaw; of these the first four are not of great size, but the last three are, viz.

1. *Deep temporal.* (N. temporales profundi.) Commonly two in number, distributed to the temporalis muscle.

2. *Temporal.* Passes outwards behind the neck of the lower jaw, divides into twigs to the ear, and to the side of the head, and forms communications with branches of the facial nerve.

3. *Buccal.* (N. buccinatorius.) Is of larger size, passes downwards between the pterygoidei muscles to the buccinator, and furnishes branches to the pterygoideus internus and buccinator muscles, and to the membrane and glands of the cheek.

4. *Pterygoid.* (N. pterygoideus.) Distributed to the pterygoideus internus muscle.

5. *Masseterine.* (N. massetericus.) Passes along the outer side of the pterygoideus externus, behind the tendon of the temporalis, winds round the neck of the lower jaw to supply the masseter muscle.

6. *Dental, alveolar.* (N. dentalis, alveolaris maxillæ inferioris, maxillaris inferior.) Passes downwards and outwards first between the pterygoidei, and then between the pterygoideus externus and the condyle of the lower jaw

X till it nearly reaches the for: lac: orbit: sup: where it is placed below & rather to the outer side of the Opthalmic branch and enters the orbit.

to the inferior maxillary foramen. Before entering that opening it detaches a branch which takes its course on the inside of the lower jaw to the mylo-hyoideus, to which and to the submaxillary gland it is distributed. The nerve then enters the alveolar canal, along which it passes, distributing branches in its course to the teeth of the under jaw. It passes out through the mental foramen and divides under the depressor anguli oris into branches distributed to the skin and muscles of the chin and lower lip, and to the membrane and glands of the mouth.

7. *Lingual, gustatory.* (N. lingualis gustatorius.) Takes its course downward and forward behind the pterygoideus externus, where it receives the communicating branch, *chorda tympani,* of the facial; is continued between the pterygoidei, then between the internus and the ascending plate of the lower jaw. Near the angle of the jaw, and above the submaxillary gland, it sends branches to this gland, which sometimes come off from an enlargement of the nerve called the *maxillary ganglion.* The nerve then passes forward with the duct of the submaxillary gland, between the sublingual gland and the hyo-glossus muscle, giving off branches to the sublingual gland and to the membrane of the mouth, which communicate with the lingual nerve; and divides into branches, which passing principally to the apex and sides of the tongue, are distributed to the skin which covers these.

VI. Outer Oculo-muscular. *N. oculo-muscularis externus, abducens, par sextum.* Takes its course from the posterior edge of the pons Varolii, forward and outward, passes through the dura mater near the posterior clinoid process, and is continued on the outer side of the internal carotid artery between it and the ophthalmic branch of the fifth pair along the cavernous sinus~~, protected from the blood which it contains by the lining membrane of the sinus~~. It detaches some filaments by which it is connected with the sympathetic, and passing through the foramen lacerum orbitare, is distributed entirely to the abductor oculi. It sometimes detaches a twig to the lenticular ganglion.

VII. Auditory. *N. auditorius, acusticus, portio mollis, par septimum.* After passing round the crus cerebelli, it takes its course outwards and forwards, and enters the meatus auditorius internus, along which it is continued. In this canal it divides into two branches for the supply of the labyrinth of the ear; one of which is distributed to the membrane of the cochlea, and the other to that of the vestibule and semi-circular canals.

VIII. Facial. *N. facialis, communicans faciei, portio dura septimi paris.* Consists of two portions, one larger; and one smaller, called the *portio media,* situated between the former and the auditory nerve. Takes its course with the auditory nerve, being received in a depression on its inner side, and is continued with it through the meatus auditorius internus. At the bottom of this passage it separates from the auditory nerve or portio mollis; passes through the stylo-mastoid canal, and quits it at the stylo-mastoid foramen. In this canal, it receives the superficial or recurrent branch of the pterygoid, and is thereby connected with the second division of the fifth pair. It detaches small twigs to the tympanum, and sends off a considerable branch to the—

1. chorda tympani, which directed upwards, enters the tympanum from behind, then passes forward between the malleus and incus, quits the tympanum through the foramen glenoideum, and, on the inside of the ascending plate of the lower jaw, joins with the lingual branch of the inferior maxillary nerve.

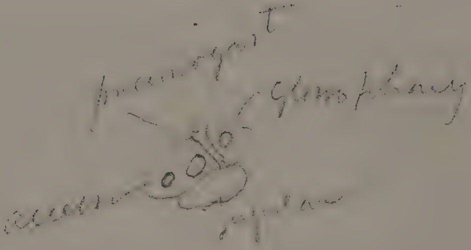
The facial nerve, after issuing from the stylo-mastoid foramen, is directed forward and a little downwards, situated deep behind the parotid gland and crossed by the posterior aural artery. It gives off,

2. branches to the auricle and to the parts about the angle of the jaw; viz.

a. *Branch* called auricular (N. auricularis) which ascends behind the ear, and is distributed to the back of the ear and to the head—*β.* *Branch* (N. stylo-hyoideus) distributed to the muscles attached to the styloid process, and giving off some twigs of connection with the sympathetic and cervical nerves—*γ.* *Branch* (N. digastricus) distributed to the digastric muscle, and supplying branches of connection with the glosso-pharyngeal and accessory nerves.

The facial nerve then enters the parotid gland, crosses the external carotid artery, and divides into four or five branches, forming by their junctions a kind of plexus, called the parotid plexus, *plexus parotideus,* from which branches are sent off to the side of the face and neck, viz.

3. temporal. (N. temporales.) Two or three in number, which supply small branches to the parotid gland, ascend over the zygoma to the temple, and extend as far as the forehead, furnishing twigs to the skin and muscles, and forming communications with the frontal and lachrymal branches of the first branch of the fifth pair.



and to the inner side of the

4. SUPERIOR FACIAL. (N. malares.) Commonly two small branches, which pass more forwards than the former, and are distributed to the orbicularis palpebrarum, and to the parts about the outer angle of the eye, and join with the malar branch of the second branch of the fifth pair.

5. MIDDLE FACIAL, BUCCAL. (N. buccales.) Two or three in number; they pass forwards over the masseter muscle, the largest accompanying the parotid duct, and are distributed to the skin and muscles of the cheek, to the side of the nose, and the lips. They form communications with branches of the infra-orbitar nerve, and the buccal branches of the third branch of the fifth pair.

6. INFERIOR FACIAL. Passes forward over the lower part of the masseter, and is distributed to the skin and muscles of the lower lip, joining with the termination of the dental nerve.

7. DESCENDING. Commonly two in number. The upper passes forwards along the edge of the lower jaw, is distributed to the skin and muscles of the chin and lower lip, and joins with branches of the dental nerve: the lower divides into two or three branches, which descend upon the side of the neck, are distributed to the skin and platysma myoides, and form junctions with branches of the third cervical nerve.

IX. GLOSSO-PHARYNGEAL. *N. glosso-pharyngeus.* It passes forward and outward with the pneumo-gastric nerve, of which, until of late, it has been considered a part, and is continued with it through the foramen lacerum basis cranii. At this part it has a gangliform enlargement, from which filaments are given off, forming connections with the recurrent branch of the pterygoid, with the sympathetic, and with the pneumo-gastric and accessory nerves. It then passes down before the internal jugular vein, quits the pneumo-gastric nerve, and is continued downward and forward *between* the carotid arteries, and along the stylo-pharyngeus, to the under and back part of the tongue. Soon after issuing from the cranium, it is connected by a filament with the facial, and by another with the pneumo-gastric, and detaches one or two filaments, which descending along the internal carotid, and then along the common carotid artery, join with filaments of the pharyngeal branch of the pneumo-gastric, and at the lower part of the neck with the superficial cardiac nerve. The glosso-pharyngeal detaches also twigs to the stylo-pharyngeus, the constrictores pharyngis, and to the tonsil, and divides into branches to the parts about the passage of the fauces, the muscular structure of the tongue, and to the skin and papillæ at the root of the tongue.

X. Pneumo-gastric. *N. pneumo-gastricus, vagus, par octavum.* It passes out of the cranium ~~with~~ the former nerve, through the lacerated foramen, and is continued through the neck and chest into the abdomen, terminating by distributing branches to the stomach, and in its course furnishing branches to the upper part of the alimentary canal and to the respiratory organs. It is at first situated before the internal jugular vein; and is closely connected by cellular membrane with the glosso-pharyngeal, the lingual, and the sympathetic nerve. It then descends, separated from the ~~glosso-pharyn~~geal by the internal jugular vein, and quitting the lingual nerve; it passes through the neck rather behind the common carotid artery, between it and the internal jugular vein, and included in the same sheath of cellular substance with these vessels. It is continued into the chest, passing on the right side, between the subclavian vein and artery, and on the left side before the arch of the aorta. It then takes its course through the posterior mediastinum by the side of the œsophagus, and is continued with it through the diaphragm, terminating by branches to the stomach. It gives off X

1. small branches. Small ones of communication with the accessory and glosso-pharyngeal nerve, and with the superior cervical ganglion.

2. pharyngeal. (N. pharyngeus.) Formed in part by a branch or two from the accessory nerve. It passes downwards on the inner side of the internal carotid artery, forms on the pharynx the pharyngeal plexus, *pl. pharyngeus*, which receives likewise filaments from the laryngeal and glosso-pharyngeal nerves, and from the superior cervical ganglion, and is distributed to the constrictors of the pharynx; some filaments descending upon the carotid with those of the glosso-pharyngeal. Near the point at which the pharyngeal branch is given off, the pneumo-gastric nerve becomes enlarged, softer, and redder, so as to present the appearance of a ganglion at that part.

3. laryngeal. (N. laryngeus, laryngeus superior.) Arises commonly from the enlargement above-mentioned. It passes downward and inward *behind* the carotid artery, receiving some filaments from the pharyngeal plexus,

x on the outer edge of and behind

x acceſsory -

x just across and then

and from the glosso-pharyngeal nerve; and divides into an external and an internal branch.

a. *External* is distributed to the inferior constrictor of the pharynx, to the muscles of the larynx, and by some twigs to the thyroid gland and membrane of the larynx.

β. *Internal* takes its course between the os hyoides and thyroid cartilage to the interior of the larynx, and divides into branches to the muscles of the arytænoid cartilages, the mucous glands, and membrane of the larynx.

4. FILAMENTS, which accompany those of the pharyngeal and glosso-pharyngeal upon the carotid artery.

5. CARDIAC BRANCHES. (Rami cardiaci.) Two or three in number, of small size, which arise about the middle of the neck, descend along the outer and fore part of the carotid, join with the superficial cardiac branches, and are spread upon the arch of the aorta.

6. RECURRENT. (N. recurrens, laryngeus inferior.) Arises as soon as the nerve enters the chest; the left, however, is given off lower than the right. It first descends directed backwards, then passes upward behind the subclavian artery on the right side, and behind the arch of the aorta on the left, and ascends between the œsophagus and trachæa, as high as the larynx, where it divides into branches distributed to the inferior constrictor of the pharynx, to the muscles of the arytænoid cartilages, and to the lining membrane of the larynx: forming junctions by several filaments with branches of the laryngeus superior, and on the right side it joins with the superficial cardial of the sympathetic which does not pass further. In its course the recurrent nerve distributes numerous branches; viz.

a. *Filaments,* which join with the cardiac branches of the pneumo-gastric, and with those of the great sympathetic, passing to the cardiac plexus.

β. *Tracheal,* (R. trachæales interiores) which are distributed to the lining membrane of the trachæa to the pharynx, and œsophagus; some of these descending before the air-tube join with the former, and with the pulmonary plexus.

7. PULMONARY. (R. trachæales inferiores.) Five or six small branches, given off behind the root of the lung, which pass partly before and partly behind the air-tube and its branches forming the PULMONARY PLEXUS. The anterior

join with the filaments from the recurrent, and with some from the inferior cervical ganglion. The posterior filaments of the pulmonary plexus, and formed in part likewise by filaments from the superior thoracic ganglion. The branches from the plexus are continued with the bronchia on each side, and are distributed principally to the lining membrane of their ramifications.

8. ŒSOPHAGEAL. After the pneumo-gastric has given off the pulmonary branches, it divides on the right side into five or six, and on the left side into two or three fasciculi; these separate, but are connected by several communicating branches, forming the ŒSOPHAGEAL PLEXUS. The branches again unite forming a cord on each side, which descends upon the œsophagus, and, connected by anterior branches, distributes filaments to the œsophagus and aorta.

9. CORONARY. The two branches above described descend with the œsophagus through the aperture of the diaphragm and terminate on the stomach. The right is distributed on the right side and posterior surface, it forms an intricate plexus about the cardia, sends branches along the less curvature, and forms junctions with the left branch, and with filaments of the sympathetic, distributed to the stomach, it forms the SOLAR PLEXUS. The left is distributed to the anterior surface by several branches, extending towards the pylorus, and form junctions with filaments of the right, and with branches of the sympathetic. The distribution of these branches, by which the pneumo-gastric terminates, is called the CORONARY or STOMACHIC PLEXUS.

XI. LINGUAL. *N. lingualis, hypo-glossus.* Comes off from the anterior surface of the medulla oblongata, by several separate fasciculi, which, after passing through the dura mater in two or three divisions unite to form a single nerve, continued through the anterior condyloid foramen. It takes its course downwards, is joined by a twig from the pneumo-gastric, from the sub-occipital nerve, and from the superior cervical ganglion, and appearing between the internal carotid artery and internal jugular vein, is thence directed forwards in a bend and crosses *before* both carotids, at the origin of the occipital artery; it continues its course behind the termination of the facial vein, and before the external carotid artery, near the os hyoides passing behind the digastricus and stylo-hyoideus, between them and the stylo-glossus. The lingual nerve is in contact with the corresponding artery, until it has reached the side of the tongue, but here is continued forwards

upon the hyo-glossus muscle, dividing into branches, distributed to the muscles under the tongue and to the fleshy part of the tongue itself, and joining by one or two branches with the gustatory branch of the fifth pair

It sends off in its course the

1. *Descending branch,* (R. descendens lingualis, vel noni,) which comes off near the root of the occipital artery. It descends along the external carotid artery, and lower on the inner side of the internal jugular vein, and is sometimes included in the sheath of the vessels. It then turns forward, sending a branch to the omo-hyoideus, and filaments to the muscles of the larynx; and forms an arch, with a branch from the second and third cervical nerves, from which branches are given off to the omo-hyoideus, sterno-hyoideus, and sterno-thyroideus.

2. *Muscular branches.* Distributed to muscles between the maxilla and the os hyoides.

§ 2. SPINAL NERVES.

They consist of thirty-one pairs divided into the cervical, dorsal, lumbar and sacral nerves.

CERVICAL NERVES.

Accessory. *N. spinalis ad par vagum accessorius, N. accessorius Willisii.* Arises from the back part of the lateral surface of the spinal marrow by numerous filaments, which come off close to the posterior roots of all the cervical nerves; although sometimes it has fewer roots. It passes up near the posterior roots of the upper cervical nerves, and enters the cranium through the foramen magnum; then takes its course with the pneumo-gastric, and passes with it through the lacerated opening of the skull; but, sometimes, through a separate opening of the dura mater. It then detaches a branch, which forms a junction, by separate filaments, with the pharyngeal and pneumo-gastric nerves. The nerve descends behind the internal jugular vein, then between that vessel and the sterno-mastoid muscle; passes through the sterno-mastoid, detaching branches which unite with branches of the second and third cervical nerves, with twigs of the fourth and fifth, and terminates on the inner surface of the trapezius.

Suboccipital. *N. infra-occipitalis, cervicalis primus, decimus cerebri.* Is of very small size. It arises from the beginning of the spinal cord on its fore part, commonly by a single root, and sometimes by two, like the other spinal nerves. It passes out between the occipital bone and the transverse process of the atlas, where it becomes slightly enlarged, and, at the posterior edge of the atlas, divides into two branches. The anterior smaller passes forwards between the transverse process of the first vertebra and the mastoid process, divides into filaments, joining with the first cervical, the lingual and the sympathetic nerve, and furnishes twigs to the adjacent parts. The posterior larger passes backward and divides into branches to the recti and obliqui capitis.

The other Cervical Nerves consist of seven pairs. The three upper cervical are smaller than the lower. The anterior branches of the upper, form junctions with each other, soon after passing from the vertebral foramina, and from these other branches arise, which again uniting and dividing, form an intricate plexus, which has been called the cervical plexus: from this plexus nerves of communication pass to the sub-occipital nerve and to the superior and middle cervical ganglion of the sympathetic, and some anatomists describe all the cervical branches as originating from it.

1. Cervical. *N. cervicalis primus.* Passes out between the atlas and dentata, and divides into two branches, an anterior and posterior.

1. *Anterior*, or smaller, passes forward, sends a branch upward, to join with the suboccipital, from which filaments are detached to join with the superior cervical ganglion, with the lingual, and the pneumo-gastric nerve; and sends a branch downward to join with the second cervical.

2. *Posterior, Large Occipital Branch.* (N. occipitalis maximus.) Is directed backward, and, after furnishing branches to the extensors of the head and neck, ascends upon the occiput, and divides into branches to the skin and occipito-frontalis, some of its filaments forming junctions with branches of the fifth pair and the facial nerve.

2. Cervical. *N. cervicalis secundus.* Larger than the former, passes out between the second and third vertebra, and divides into an anterior and posterior branch.

1. *Anterior.* Supplies some filaments to the muscles on the fore part of the vertebræ, detaches branches

to join with the upper cervical ganglion, and with the first and third cervical nerves, by which junctions are formed with the descending branch of the lingual and with the accessory nerve, then divides into two branches, the superficial of the neck and the small occipital.

a. Superficial of the neck. (N. superficialis colli.) Bends round the posterior edge of the sterno-mastoid and divides into branches (N. subcutanei) which spread on the side of the neck, and are distributed to the skin especially about the lower jaw, forming several communications with each other, and with branches of the facial nerve. One of its branches, the auricular (N. auricularis magnus) takes its course directly upward behind the jaw to the auricle, and furnishes branches to its skin and muscles.

β. Small occipital. (N. occipitalis minor.) Passes upward, commonly soon dividing into several branches, over the splenius and trachelo-mastoideus, forms junctions with branches of the facial and occipital nerves, and is distributed to the skin of the occiput and back part of the ear, and to the adjacent parts.

2. *Posterior*. Smaller, passes backwards between the muscles, detaches branches of connection to the first and third cervical, and is distributed to the extensors of the head and neck, and to the skin of the neck.

3. CERVICAL. *N. cervicalis tertius.* Is smaller than the former. It passes out between the third and fourth vertebra, and divides into an anterior and posterior branch.

1. *Anterior*. Larger, detaches a branch to join with the fourth, and another with the second cervical, a branch which joins with the great sympathetic or superior cervical ganglion, and a branch which joins with the descending branch of the lingual. It furnishes branches to the longus colli, and levator scapulæ, and divides then into three or four branches (N. supra-claviculares) which descend and are distributed to the skin about the clavicle and adjacent parts.

2. *Posterior*. Smaller, it passes deep-seated between the muscles, and is distributed to the extensors of the head and neck.

DIAPHRAGMATIC NERVE. (N. phrenicus, diaphragmaticus.) Arises by different filaments from the lower cervical nerves; the most considerable filament is from the anterior branch of the fourth, but it receives a smaller from the third, and commonly one from the second, and often a filament or two from the axillary plexus. It takes its course downward between the rectus capitis and scalenus anticus, next on the inner edge of the scalenus between the subclavian artery and vein, and enters the chest. It is then directed forwards, passes before the root of the lung, and descends between the pericardium and pleura. As it approaches the diaphragm it divides into several branches which are distributed to the convex part of that muscle. Some of the branches pass through the diaphragm with the inferior cava, distribute filaments to the under surface of the diaphragm, and form connections with filaments of the solar plexus. The left lies farther back, is longer than the right, and furnishes some twigs to the œsophagus.

The Four Inferior Cervical and the First Dorsal Nerve are of large size, especially the sixth cervical. These form by their junctions the Axillary Plexus, from which the nerves originate supplying the upper extremity. They pass out under the corresponding vertebræ, and after issuing from the vertebral foramina, send small branches to the muscles of the back: take their course outward and downward between the scalenus anticus and medius, accompanying the subclavian vessels, being situated above and behind, and to the outer side of the artery. They pass with these vessels under the clavicle, and retain the same relative position with respect to the axillary vessels, as far as the part opposite to the coracoid process of the scapula: but they here pass around the artery so as to conceal it. During this course the nerves divide, join and separate again, so as to form the Axillary or Brachial Plexus. The nerves which come off from the plexus are the—

1. Thoracic. 2. Scapular. 3. Articular. 4. Inner cutaneous. 5. Inner smaller cutaneous. 6. Outer cutaneous. 7. Radial. 8. Median. 9. Ulnar.

§ 3. NERVES FROM THE AXILLARY PLEXUS.

1. Thoracic. *N. Thoracici.* Consist of branches derived from the fourth, fifth, and sixth cervical. They descend upon the parietes of the chest, and are distributed to the subclavius and pectorales, and to the skin of the chest and shoulder; one branch commonly descending upon the serratus magnus, and distributed to it.

2. Scapular. *N. scapularis.* Frequently from the fourth and fifth cervical. Passes downward and backward, is continued through the notch of the scapula to the fossa supra-spinata, and furnishes twigs to the supra-spinatus:

then directs its course along the root of the acromion, and divides into branches for the supply of the infra-spinatus and teres minor.

3. Articular. *N. articularis, circumflexus brachii.* Arises from the trunk formed by the junction of the fourth and fifth cervical. It detaches twigs to the subscapularis and to the teres major and minor, and takes its course, between the two last-named muscles and the long head of the triceps, round the os humeri just below the head, to the inner surface of the deltoid, to which it is distributed. One branch passes through the muscle, and divides into twigs to the skin.

4. Inner Cutaneous. *N. cutaneus internus.* Generally formed by several fibrillæ of the first dorsal, and sometimes in part from the seventh cervical. It takes its course down the inner side of the arm, immediately under the skin, in the course of the basilic vein, and near the radial nerve, and after detaching one or two inconsiderable twigs as it approaches the elbow, divides into two branches;—of which the smaller is directed backward, and runs down on the inner and back part of the fore arm, dividing and distributing twigs to the skin as far as the little finger:—the other and larger descends on the inner and fore part of the fore arm, dividing into several twigs which pass partly over and partly behind the subcutaneous veins, and supply the skin as far as the wrist and the palm of the hand.

5. Inner Small Cutaneous. *N. cutaneus internus minor.* Is connected principally with the ulnar nerve, and is much smaller than the former. It soon divides into two branches, which distribute twigs to the triceps and to the skin of the back part of the arm, and of the elbow.

6. Outer Cutaneous. *N. cutaneus externus, musculo-cutaneus perforans.* Formed by the fourth, fifth, and sixth cervical, and sometimes by a branch of the median. It passes downward and outward, perforates commonly the coraco-brachialis, or takes its course on the inside of that muscle, and furnishes some twigs to it. It descends then between the biceps and brachialis internus, giving off some branches to both, as far as the bend of the elbow, where it is situated on the outer side of the tendon of the biceps, between it and the cephalic vein. It continues its course on the outer side of the fore arm under the skin, to which it distributes numerous twigs, as far as the root of the thumb and back of the hand.

7. Radial. *N. radialis, spiralis.* Is of large size, and is formed by fasciculi from all the nerves of the axillary plexus. It takes a spiral direction, directing its course behind the os humeri between the two heads of the triceps; it then makes its appearance on the outer side of the arm, descends between the brachialis internus and extensores carpi radiales, and divides into a superficial and deep branch. Before the division it distributes—

1. *Branches* to muscles—a branch to the latissimus dorsi—branches to the heads of the triceps.

2. *Cutaneous branch*, given off behind the body of the os humeri, which descends on the outer and back of the arm, and is distributed to the skin of the fore arm.

3. *Branches* to the supinator longus and extensors.

4. *Superficial.* (R. superficialis dorsalis.) Descends on the inner side of the supinator longus, giving off some twigs to the radial extensors, and then accompanies for some way the radial artery; but towards the lower part of the fore arm it passes backward under the tendon of the supinator longus, and divides into two branches, a dorsal and a palmar.

a. Palmar passes to the thumb, furnishing twigs to the skin of the wrist and to the muscles and skin of the thumb, and terminates on the skin of the back part of the thumb. It forms junctions with twigs of the external cutaneous nerve.

β. Dorsal divides into twigs distributed to the skin of the back of the hand, to the muscles between the index and thumb, and its principal branches are disposed on each side of the fore and on the outer side of the middle finger.

5. *Deep.* (R. profundus muscularis.) Passes deep-seated backward upon or through the supinator brevis, and descends on the back of the arm, between the extensors of the fingers, taking its course under the extensor digitorum and the extensor primi internodii pollicis, as far as the wrist, to the parts about which it is ultimately distributed. In its course it furnishes branches to the supinator brevis, extensores radiales, and to the extensors of the thumb and fingers.

8. Median. *N. medianus.* The most considerable of the nerves from the axillary plexus; formed by fasciculi from all the nerves composing this plexus. It descends on the inner side of the biceps, with the brachial artery, situated on the inner and fore part of that vessel as far as the bend of the elbow: here it passes over the tendon of the brachialis internus, and descends through the fore arm about midway

between the radius and ulna. In the fore arm it takes its course first behind, or through, the pronator teres, and continues its course between the superficial and deep flexors of the fingers. At the lower part of the fore arm it commonly divides, the branches being continued behind the annular ligament of the wrist, between the tendons of the flexors, to the palm of the hand, and here subdivide into branches to the thumb and fingers. The median in its course through the upper arm, furnishes only some inconsiderable twigs to the coats of the vessels. As it approaches the elbow it detaches

1. *Branches* to the pronator teres, palmaris longus, flexor carpi radialis, and flexor sublimis.

2. *Interosseous*, (N. interosseus,) given off at the bend of the joint, which after giving off branches to the flexor profundus digit. and flexor longus poll. descends upon the interosseous ligament, with the corresponding vessels, turns over the edge of the pronator quadratus, and terminates in that muscle.

3. *Palmar*, a cutaneous branch given off near the wrist, and supplying the adjacent skin, and that of the back of the thumb.

The branches into which it divides in the palm of the hand are three or four in number, viz.—

4. *Branch*, which divides into two to the thumb, and one to the fore finger; of which the former pass at the sides of the thumb to its extremity, and the latter takes its course along the outer side of the fore finger.

5. *Digital Branch*, which passes to the interstice between the roots of the fore and middle finger, and here divides into two, one of which passes along the inner side of the fore finger, and the other along the outer side of the middle finger, severally to the tip of each.

6. *Digital Branch*, which passes to the interstice between the roots of the middle and ring finger, where it divides like the former into two branches which are continued, the one along the inner side of the middle, and the other along the outer side of the ring finger, to their tips.

These and the preceding digital branches furnish twigs to the skin of the fingers, but are principally distributed to the skin of the tips of the fingers.

9. Ulnar. (N. ulnaris, cubitalis.) Somewhat smaller than the former. Is formed from the three undermost nerves of the plexus. As it descends it is inclined backward on the triceps muscle with which it is connected. Near the elbow

it passes backward behind the inner condyle of the os humeri, situated in the groove between the condyle and olechranon process of the ulna, with the recurrent ulnar artery. It takes its course in the fore arm first between the heads of the flexor carpi ulnaris, then between it and the flexor digitorum, and descends on the inner side of the fore arm with the ulnar artery, being situated on the inner side of that vessel. It passes with the artery over the annular ligament into the palm of the hand, and there terminates by dividing into a superficial and deep branch. In its course through the upper arm it detaches no branches, except, in some cases, the inner cutaneous nerve. In the fore arm it gives off

1. *Branches* near the elbow to the flexor ulnaris and flexor profundus.

2. *Cutaneous* branch, which descends under the skin, in the course of the basilic vein, and is distributed to the skin as far as the hand.

3. *Dorsal* (N. ulnaris dorsalis) given off at the lower part of the fore arm; passes backward between the flexor ulnaris and ulna, just above or upon its base, and divides into twigs, supplying the skin of the back of the hand, and the skin of the inside of the middle and both sides of the ring finger and little finger, and forming junctions with twigs of the radial nerve.

Of the two branches by which it terminates—

4. *Superficial palmar* is connected by one or more twigs to branches of the median. It gives off

α. *Branches* distributed to the muscles of the little finger.

β. *Digital branch,* which is continued along the inner side of the little finger to its tip.

γ. *Digital branch,* which passes to the interstice between the roots of the ring and little fingers, and there divides, sending one branch along the outer side of the little finger, and another along the inner side of the ring finger to their extremity.

5. *Deep palmar* passes deep-seated between the flexor and abductor of the little finger, and is then directed transversely outward behind the tendons of the flexors, furnishing twigs to the lumbricales, the interossei, and adductor pollicis muscle.

§ 4. THORACIC NERVES.

Consist of *twelve* pair which are comparatively of small size. The first pair has been already spoken of with the lower

cervical as entering into the composition of the axillary plexus; the remaining eleven only, therefore, remain to be described.

Immediately after passing out of the vertebral foramina, each nerve is connected by short branches with the nearest ganglion of the sympathetic, and soon after divides into two branches, an anterior and a posterior.

1. POSTERIOR. Passes backward between the transerse processes of the vertebræ, and is distributed to the muscles situated near the spine.

2. ANTERIOR. Takes it course along the under edge of that rib, under which the trunk issues from the vertebral canal, between the layers of intercostal muscles with the intercostal vessels, and more or less in the costal groove; but as it advances it becomes farther removed from the upper rib, and, near the sternum, passes upon the exterior of the chest. In its course it furnishes branches to the intercostal muscles, the upper part of the abdominal muscles, and twigs which, penetrating the intercostal muscles, are distributed to the muscles of the upper extremity and skin covering the chest.

There are, however, some differences to be observed in these nerves. The first is the largest; the second is much smaller, and from the second they then increase in size, but not regularly, to the twelfth. There is also some difference in the distribution of the anterior or intercostal branches.

The *first thoracic nerve* takes its course upward and outward over the first rib to join the axillary plexus; opposite that rib dividing into two branches, one of which joins with the axillary plexus as above described, whilst the other smaller branch takes its course under the first rib like the other intercostal branches.

The *second* and *third* differ from the rest in detaching each a branch, called

Intercosto-humeral, to the skin of the upper arm. These two branches penetrate the intercostal muscles under the second and third ribs, and are distributed to the skin of axilla and inner part of the arm as far as the elbow.

The *five uppermost* are distributed principally to the pectorales and serratus muscles. The seven lowermost principally to the abdominal muscles. The eleventh and twelfth distribute branches to the lesser muscle of the diaphragm, to the quadratus and psoas muscles. The rest of their distribution is as before described.

The *twelfth dorsal* is connected by a small branch with the first lumbar.

§ 5. LUMBAR AND SACRAL NERVES.

There are five pairs of lumbar, and five pairs of sacral nerves. The *lumbar* pass through the foramina formed by the lumbar vertebræ, and the last nerve through the foramen, formed by the last vertebra and the sacrum.

The *sacral* take their course through the anterior sacral foramina, and the last between the sacrum and the os coccygis.

The *anterior* branches of these nerves, ten in number on each side, form by their connections a kind of plexus, sometimes described as the lumbar and sacral plexus, which may be termed the Crural Plexus: from this plexus the nerves are derived, supplying the whole of the lower extremity, the roots of the nerves being here variously intermingled and connected. The anterior branches of the lumbar nerves passing behind the psoas, are connected with each other; in addition, the first being joined to the last dorsal, and the last to the first sacral nerve: the anterior branches of the sacral, especially the three uppermost, contribute in the same way by their junction to the formation of this plexus.

Of the nerves which form this plexus, those which are situated in the middle are the most considerable, that is to say, the fifth lumbar and the first sacral; they then diminish in size upward and downward, but not with exactness, the first lumbar and the third sacral being nearly of the same size, and the two last sacral the least, especially the fifth, which is generally the smallest of all the spinal nerves. The fourth and fifth sacral nerves are connected with the crural plexus, but do not contribute to form the principal nerves arising from it.

Small *posterior* or *dorsal* branches arise from all the nerves which enter into the composition of the crural plexus, which take their course backward; those from the lumbar passing between the transverse processes of the lumbar vertebræ and of the sacrum; those from the sacral passing through the posterior sacral foramina: they are distributed to the under part of the muscles of the back, to the gluteus maximus and the adjacent skin.

Branches from the Lumbar and Sacral Nerves, forming the Crural Plexus.

Some of them are of small size, derived only from one or two of the nerves, viz. the external spermatic nerves, the

branches distributed to the muscles of the loins, and the branches to the skin about the hip and groin, the gluteal nerves, &c. The larger are formed by fasciculi from several nerves: they are the obturator, pudic, crural, and ischiatic nerves.

1. External Spermatic. *N. spermaticus externus, pudendus externus.* Is derived from the first and second lumbar. It passes through the upper part of the psoas muscle, and descends on its anterior surface. It divides then into two branches, one of which accompanies the spermatic vessels, and distributes in the male branches to the scrotum, cremaster, and cord; in the female to the round ligament, and in both to the skin of the pubes and groin; the other branch passes behind Poupart's ligament, and is divided into branches to the integuments of the fore part of the thigh.

2. Branches from the First and Second Lumbar. *N. Abdominales.* Distributed to the psoas, quadratus, and transversalis abdominis muscles, and to the skin about the loins and hip. There are generally one or two long branches, which penetrate the psoas, take their course over the quadratus, pass through the transverse and internal oblique muscles of the abdomen, furnishing twigs to these muscles: are then continued through the tendon of the external oblique, and spread to the skin of the groin and scrotum.

3. External Cutaneous. *N. cutaneus externus.* Generally derived from the third lumbar. It takes its course between the psoas and iliacus, and descends upon the latter muscle. It is continued under the outer extremity of Poupart's ligament, close to the superior anterior spinous process of the ilium, and divides into branches, distributed to the skin of the fore and outer part of the thigh, as far as the knee.

4. Superior Gluteal. *N. glutæus superior.* Is formed by the fourth and fifth lumbar, before their junction with the first sacral, to form the ischiatic. It passes directly under the edge of the notch of the ilium, and is distributed to the small and middle gluteal muscles, some of the twigs extending as far as the tensor vaginæ femoris.

5. Inferior Gluteal. *N. glutæus inferior.* Is formed by fasciculi from the second and third sacral nerves; passes out of the pelvis under the pyriform muscle, to which

it detaches twigs, and is distributed to the large gluteal muscle.

6. Common Pudic. *N. pudendus communis.* Formed by fasciculi from the fourth and fifth lumbar, and from the three uppermost sacral nerves; it is of considerable size. It passes out of the pelvis through the under part of the notch of the ilium, then is continued into the pelvis again, between the two sacro-sciatic ligaments, and divides into a superior and inferior branch.

1. *Superior.* (N. pudendus superior.) Takes its course along the ramus of the ischium and that of the os pubis, giving off twigs to the obturator internus muscle, is then continued forwards under the symphysis pubis, in the male as the dorsal nerve of the penis, (N. dorsalis penis,) in the female as the nerve of the clitoris, (N. clitorideus,) and in both distributes twigs upon the dorsum, and to the skin of the pubes and adjacent parts, and terminates in the glans.

2. *Inferior.* (N. pudendus inferior, hæmorrhoideus.) Accompanies the superior for a short way, ascends then between the accelerator urinæ and erector penis, and is distributed to the skin and muscles of the perineum, to the extremity of the rectum, to the skin of the scrotum, and to the urethra, and is connected by various twigs with the other branches supplying the groin, the rectum, and parts of generation.

7. Branches from the Third, Fourth, and Fifth Sacral. Arise from these nerves separately; are distributed to the rectum, to the sphincter and levator ani muscles; to the bladder, uterus, and vagina, in the female; and to the bladder, prostate gland, and vesiculæ seminales, in the male; and assist in forming the Hypogastric Plexus, see page 397.

8. Obturator. *N. obturatorius.* Is derived from the anterior fasciculi of the second, third, and fourth lumbar nerves; passes downward and forward from behind the psoas muscle, takes its course in the direction of the linea ilio-pectinea, accompanied by the vessels of the same name, and is continued through the aperture in the ligament which fills up the obturator foramen. It then divides into an anterior and posterior branch.

1. *Anterior.* Is distributed to the adductor longus

and brevis, and to the gracilis, and is connected by different twigs with the inferior cutaneous nerve.

2. *Posterior.* Is distributed to the obturatores and adductor magnus.

9. Crural. *N. cruralis.* Is more considerable than the obturator; derived from the junction of the principal portions of the four upper lumbar nerves. It passes downward and outward, between the psoas and iliacus muscles, to both of which it furnishes twigs; continues its course on the outer side of the psoas, descends behind Poupart's ligament into the thigh, and crosses over the conjoined tendons of the psoas and iliacus; it is here placed exterior to the sheath of the femoral vessels, on the outer side of the artery, and in the upper part of the thigh, divides into branches distributed to the skin and muscles.

1. *Superior cutaneous.* (N. cutaneus superior.) Comes off sometimes above Poupart's ligament, and is joined by other twigs, arising near that part. It divides into from three to six branches, which are distributed to the skin, on the fore and inner part of the thigh, as far as the knee.

2. *Muscular branches.* Are considerable in size and number, and are distributed to the rectus, cruralis, vasti, adductores, and tensor vaginæ femoris muscle.

3. *Inferior cutaneous.* (N. cutaneus inferior, N. saphænus.) Descends behind the sartorius muscle, to which it gives off some twigs, and on the outer and fore part of the femoral artery, connected with and sometimes enclosed in the sheath, which contains this vessel. (N. B. There is a nerve accompanying the inferior cutaneous in its descent, which passes into the vastus internus, at the lower part of the thigh.) The inferior cutaneous continues its course through the tendons of the triceps, on the inner side of the knee becomes subcutaneous, and accompanies the saphæna vein in its course along the inner side of the leg to the inner and upper part of the foot. In its course, it distributes branches to the integuments of the knee and inner part of the leg and foot, as far as the great toe.

10. Ischiatic. *N. ischiaticus.* The largest nerve in the body, is formed by the junctions of the largest portions of the fourth and fifth lumbar, and of the three uppermost sacral nerves. It passes out of the pelvis, between the pyriformis and gemini muscles; sometimes penetrates the pyriformis, and sometimes a slip of the pyriformis is interposed between its fasciculi. It takes its course over the rotator muscles,

between the tuberosity of the ischium and trochanter major, covered by the large gluteal muscle; descends in the back part of the thigh, between the flexors of the leg and the adductor magnus, and about the middle of the thigh divides into the *tibial* and *peroneal* nerves. The division is seldom lower, but sometimes much higher, and occasionally above the tuberosity of the ischium, so that its two branches are separated by the pyriform muscle. The branches which it gives off are

1. *Twigs* to the obturator internus, gemini, and quadratus muscle.

2. *Branch,* connected with the inferior gluteal nerve, to the gluteus maximus.

3. *Branches* to the biceps, semi-tendinosus, semi-membranosus, and triceps muscles; these sometimes come off by a single trunk.

4. *Superior cutaneous.* (N. cutaneus superior posterior.) Is sometimes separated from the trunk near to its origin. It divides into two branches, one is continued forwards, and distributes twigs to the skin about the tuberosity of the ischium and adjacent parts: the other descends along the back part of the thigh, and distributes twigs to the skin, as far as the calf of the leg.

5. *Inferior cutaneous.* (N. cutaneus inferior posterior.) Is of a small size, and distributed like the former.

PERONEAL. *N. peroneus, fibularis.* Passes downward on the inner side of the biceps, then winds forwards round the head of the fibula covered by the peronei muscles, and divides into a *superficial* and *deep* branch. Before this division it gives off a cutaneous branch: thus the branches of this nerve are:—

1. *Cutaneous,* (N. cutaneus peroneus externus,) which takes its course downward along the outer part of the leg, between the gastrocnemius and skin, and after being connected with a branch of the tibial, distributes branches to the outer side of the foot, and terminates by dorsal branches to the fourth and fifth toes.

2. *Superficial.* (N. cutaneus peroneus internus.) Passes downward and forward between the peroneus longus and brevis muscles, becomes subcutaneous about the middle of the leg, and is continued under the skin upon the dorsum of the foot. It furnishes twigs to the skin of the lower part of the leg and dorsum of the foot; and terminates by dorsal branches to the inner side of the fourth, and to the three inner toes.

3. *Deep.* (N. peroneus profundus, muscularis.) Is

continued forwards above the former nerve between the muscles, and divides into—

α. *Recurrent branch* distributed to parts about the knee-joint.

β. *Muscular branches* to the tibialis anticus, extensor longus digitorum, extensor proprius pollicis, and peronei muscles.

γ. *Anterior tibial branch* descends with the anterior tibial artery, before which it is placed, upon the dorsum of the foot, and divides into branches to the skin, to the extensor brevis digitorum, and interossei muscles, one twig passing into the sole of the foot.

Tibial. *N. tibialis.* The inner and more considerable branch of the ischiatic, is sometimes, though improperly called, the politeal nerve, while in the ham. It descends along the outer edge of the semi-membranosus in the ham, and is situated more superficially than the vessels. It then becomes deep-seated, passes between the heads of the gastrocnemius externus, and is continued through the leg between the superficial and deep-seated layer of muscles, accompanied by the posterior tibial artery, to the outer side of which it is placed: it passes down with the artery and terminates opposite the base of the tibia by dividing into the *inner* and *outer plantar* nerves. It gives off in its course

1. *Communicating cutaneous branch*, (N. cutaneus tibialis, communicans tibiæ,) which is sometimes a branch of the peroneal or ischiatic. It descends between the gastrocnemius and skin in the course of the saphæna minor. At the lower part of the leg it is connected with the cutaneous branch of the peroneal, is continued behind the outer ankle and along the outer side of the foot, as far as the little toe, distributing in its course twigs to the skin.

2. *Branches* to the gastrocnemius, soleus, plantaris, and popliteus muscle.

3. *Branches* to the tibialis posticus, flexor longus digitorum, and flexor longus pollicis muscle.

4. *Cutaneous branch.* (N. cutaneus plantaris.) Distributed to the skin about the inner malleolus, and to that of the back part of the sole of the foot.

Inner Plantar. *N. plantaris internus.* Larger than the outer. It crosses the posterior tibial artery immediately after it is given off, and becomes placed to its inner or tibial edge; it is then continued forward above the abductor pollicis in the sinuosity of the os calcis along the tendon of the flexor longus, and after giving off branches to the muscles of the great toe, to the flexor brevis digitorum, the flexor accessorius, and to the lumbricales, divides into four *plantar digital* branches.

1. *First plantar digital,* which is continued along the inner side of the great toe to its tip.

2. *Second,* continued to the interstice between the first or great toe and the second toe, where it divides into one branch which passes along the outer side of the great toe, and another which takes its course along the inner side of the second toe.

3. *Third,* which passes to the interstice between the second and third toe, where it divides to these toes in the same manner as the former.

4. *Fourth,* which divides to supply the third and fourth toe in like manner.

OUTER PLANTAR. *N. plantaris externus.* Passes on the outer or fibular side of the posterior tibial artery till its division, when it takes its course outward and forward with the artery of the same name, between the flexor brevis and flexor accessorius; and after giving off twigs to these muscles and to the skin, divides into three branches, two *plantar digital* and one *deep* branch:

1. *Fourth plantar digital,* divides at the interstice between the fourth and fifth toes into two branches, one of which is continued along the outer side of the fourth, and the other along the inner side of the fifth toe, to their extremity.

2. *Fifth,* passes along the outer side of the foot, and after giving off twigs to the abductor of the fifth toe, is continued to its extremity.

3. *Deep,* passes obliquely inwards and forwards, deep-seated between the tendons of the flexor longus digitorum and the interossei. It gives off twigs to the interossei, transversalis, lumbricales, to the muscles of the little toe, and to those of the great toe.

§ 6. SYMPATHETIC NERVE.

N. Gangliosus, Sympatheticus, Intercostalis, Systema Gangliorum, Systema Vitæ Automaticæ.

This nerve is so essentially distinguished from the other nerves of the body, that it may be described separately, or as a separate system of nerves.

It consists of a considerable number of ganglia, (of which the number and size differ not only in different individuals,

but in the same individual on the two sides of the body,) and of branches which in part connect these ganglia, or form junctions with the other nerves, and are in part distributed to the internal organs. It extends from the base of the skull, on each side of the vertebral column, through the neck, chest and abdomen, as far as the coccyx, forming, from above to below, numerous ganglia: those in the neck are few in number, but in the rest of its course it generally forms one ganglion between every two vertebræ; these are severally connected by one or more filaments with each other, and with all the nerves of the spinal marrow; and the uppermost cervical ganglion is connected with most of the cerebral nerves. Lastly, it detaches filaments to the viscera, and those which are distributed in the abdomen form connections with a numerous set of ganglia in this cavity which are placed about the trunks of the large vessels.

The ganglia and their branches on each side of the spine will be first described, and afterwards those of the abdomen. In tracing the sympathetic nerve from above downwards from the base of the skull by the side of the vertebral column, the description will be most conveniently begun by the

CERVICAL GANGLIA.

1. SUPERIOR CERVICAL GANGLION. *Ganglion cervicale supremum, fusiforme.* Is one of the most considerable. It is situated behind the internal carotid artery, and before the transverse processes of the second and third cervical vertebra, and the rectus capitis internus major muscle. On the inner side are situated the pneumo-gastric and lingual nerves, with which it is connected by dense cellular membrane. Its form and size are subject to considerable varieties; it is most commonly of a spindle-like shape, but sometimes has different contractions; its length is usually not more than that of the second and third vertebræ, but it sometimes reaches lower, and occasionally as far as the sixth cervical vertebra, varying in breadth and thickness. Various branches pass off from its circumference; they may be divided into superior, inferior, external and anterior.

1. *Superior*, generally a single branch, which takes its course through the carotid canal to join with branches of the cerebral nerves. It is situated behind the artery, and in its course divides into two branches, which continue their course through the canal, somewhat separated from each other. Whilst still within it one of the branches joins with a branch sent off from the external oculo-muscular where

passing through the cavernous sinus; sometimes the branch of communication is double; and sometimes there is a ganglion, GANGLION CAVERNOSUM, at the point of the union. The other branch of the sympathetic joins with the recurrent branch of the second division of the fifth pair, or pterygoid nerve.

Some anatomists describe small branches also which pass from the cavernous ganglion to the fifth pair or its divisions: and of late filaments have been described by Cloquet and Bock, which, continued from the above-mentioned ganglion with the ophthalmic artery, join with the lenticular ganglion; so that this ganglion is considered as belonging to the sympathetic. Indeed, Cloquet considers the ganglion-like enlargements of the spheno-palatine and lingual branches of the fifth pair as parts of the sympathetic, and the pterygoid nerve as forming the connection between them and the cavernous and superior cervical ganglia; namely, by means of its superficial branch (which is continued as the chorda tympani) with the maxillary ganglion of the lingual, and by means of its deep branch with the spheno-palatine-ganglion.

2. *External branches:* are four in number, which sometimes come off by a single trunk. They pass over the rectus cap. intern. maj. The two upper join with the arch formed by the connection of the sub-occipital and first cervical nerves; the third joins with that formed by the second and third cervical nerves: the fourth, given off sometimes below the ganglion, joins with the arch of connection between the third and fourth cervical, and detaches twigs to the rectus capitis internus major, and scalenus anticus.

3. *Anterior branches.* They are the most considerable in size and number, and from their softer texture are called commonly the *nervi molles.* The upper and shorter ascend to join with the lingual, pneumo-gastric, and facial nerves, soon after they issue from the cranium. The inferior and larger pass downward and forward, and form a plexus of filaments which join with branches of the pneumo-gastric, and surround the divisions of the carotid, as well as the common carotid itself, as far as its origin. The most considerable of the anterior branches is the

a. Superficial cardiac, (N. cardiacus superficialis, superior,) which is formed by several filaments from the fore part of the ganglion, or from the sympathetic below it. A slender nerve is thus formed, which descends on the outer side of the common carotid, before the sympathetic; it gives some twigs to the pharynx, œsophagus, thyroid gland, and adjacent muscles, one or two of which are connected with branches of the pneumo-gastric, and terminates on the right side by branches which join with branches of the recurrent

laryngeal: but on the left side it reaches lower, and joins with the other cardiac nerves.

4. *Inferior branch* may be considered as the continuation of the trunk of the sympathetic. It varies in size and length. It descends on the rectus capitis internus major and longus colli muscle, at first behind the internal carotid, then behind and to the outer side of the common carotid artery; and sometimes divides inferiorly into two branches. It detaches twigs which join with the accessory and upper cervical nerves, and with the superficial cardiac and pneumogastric nerve; and terminates in the—

2. MIDDLE CERVICAL GANGLION. *Ganglion cervicale medium.* Is situated near the inferior thyroideal artery, between the sixth and seventh cervical vertebræ upon the longus colli. It is not so constant as the superior, but is found in the greater number of instances. It varies in shape, is sometimes very small, and occasionally double. It sends off

1. *External branches* which join with the inferior cervical nerves, commonly with the fourth, fifth, sixth, and seventh.

2. *Internal branches* which accompany the thyroideal artery, and join with the recurrent laryngeal.

3. *Anterior branches*, or *deep cardiac nerve*, (N. cardiacus profundus, magnus, medius,) five or six in number. This descends inwards, at first along the common carotid, then upon the subclavian artery, is connected by several filaments with the pneumo-gastric, and joins with the third cardiac nerve to form the cardiac plexus. The *right* descends from the subclavian along the unnamed artery, where that vessel divides, joins by means of a ganglion with one or two branches of the pneumo-gastric, and then passes between the arch of the aorta and the bifurcation of the trachæa: the *left* joins with one or two branches from the inferior cervical ganglion, (so that the middle and inferior cardiac branches which are separate on the right side are joined on the left,) then passes behind the arch of the aorta, is connected by filaments with the pneumo-gastric, and unites with the right cardiac branches to form the cardiac plexus.

4. *Inferior branches.* Form the continuation of the sympathetic; they are five or six in number. They descend before and behind the subclavian artery, to join with the inferior cervical ganglion. Sometimes there is only one short trunk which connects the middle with the inferior cervical ganglion.

3. Inferior Cervical Ganglion. *Ganglion cervicale inferius.* Is more constantly found than the middle. It varies in size and figure; but is commonly of an irregular form. It is situated before the transverse process of the seventh cervical vertebra and the neck of the first rib. It sends off

1. *External branches,* which are small. They surround the subclavian artery, and are connected with the undermost cervical and first dorsal nerve.

2. *Internal branches,* which join with the filaments forming the pulmonary plexus.

3. *Anterior,* the *lesser* or *inferior cardiac nerve.* (N. cardiacus parvus, inferior, tertius.) Is commonly only found on the right side. It takes its course behind the subclavian artery, then before the unnamed trunk to the arch of the aorta; is connected by filaments with the pneumo-gastric, passes between the aorta and pulmonary artery, and joins the cardiac plexus.

The Cardiac Plexus is principally formed by the cardiac branches of the pneumo-gastric and the sympathetic; from the latter of which on each side are given off two distinct sets of nerves which go to the plexus:

On the left.	On the right.
N. cardiacus superficialis,	N. cardiacus profundus,
N. ———— profundus,	N. ———— parvus,

whilst the cardiacus parvus on the left joins with the profundus, and the cardiacus superficialis on the right with the recurrent laryngeal. The cardiac plexus passes down upon the ascending aorta to the heart, and in its course sends filaments to the aorta and to the pulmonary plexus, but the principal part forms the *coronary plexuses.* (Pl. coronarii.) The left and more considerable plexus passes over the left pulmonary artery, and is distributed with the left coronary artery. The right passes between the aorta and pulmonary artery, and accompanies the right coronary artery and its divisions.

Thoracic Ganglia. *Gangl. thoracic. dorsalia.* In the cavity of the thorax the sympathetic passes down on the necks of the ribs and forms between the transverse processes of each two vertebræ a ganglion called thoracic, of an irregular and variable figure. They are not all of the same size, and often the middle are smaller than those above and below; the uppermost thoracic ganglion is the largest. These ganglia are all connected with each other by considerable single branches; and with the corresponding dorsal nerves,

by double filaments. From the superior ganglion small filaments are detached to the cardiac plexus and pulmonary plexus. The inferior form the splanchnic branches.

1. SPLANCHNIC. *N. splanchnicus.* Is formed commonly by filaments from all the ganglia between the fifth or sixth and the eleventh; but the number of its roots varies from three to seven. These unite to form a single trunk near the diaphragm. The splanchnic passes then through the lesser muscle of the diaphragm into the abdomen, and terminates in the Semilunar Ganglion, or in some of the ganglia connected with it. Not unfrequently one or more of the inferior roots pass separately to the semilunar ganglion, or join with some of the abdominal plexuses.

2. LESSER SPLANCHNIC. *N. splanchnicus minor.* The two or three undermost roots of the splanchnic not unfrequently join to form this separate smaller trunk, which passes through the lesser muscle of the diaphragm, lower down than the greater splanchnic nerve, is joined by filaments from the upper lumbar ganglia, and terminates principally in the renal plexus.

LUMBAR GANGLIA. *Ganglia Lumbalia.*

Are situated on the lumbar vertebræ, and are placed more forwards than the dorsal. They are of an irregular figure, much smaller than the dorsal, are placed farther from each other, and are more variable in their situation. They become smaller from above to below, so that frequently the undermost are not distinct, or are wanting. They are connected with each other by slender filaments, which vary in size and in number. Each also is connected by slender filaments with the corresponding lumbar nerve; and filaments are sent inwards to join with the aortic plexus.

SACRAL GANGLIA. *Ganglia Sacralia.*

They are generally four or five in number, and are placed in a row which converges from above to below. The last is situated between the sacrum and the os coccygis, and is united with the opposite by a short slender filament, called the GANGLION IMPAR. They are connected with each other, as well as with the last lumbar ganglion, by slender filaments, and by similar threads with the sacral nerves; and they send filaments to assist in forming the hypogastric plexus.

SEMILUNAR AND CŒLIAC GANGLIA, AND SOLAR PLEXUS. *Plexus solaris, semilunaris, abdominalis, ganglion semilunare.* Form the centre from which nerves are distributed to the viscera contained within the abdomen. They are situated before the abdominal aorta, behind the peritonæum, and surround the trunk of the cœliac artery. There are commonly two considerable ganglia, called the SEMI-LUNAR from their figure, situated one on each side, about an inch in length, and of considerable breadth and thickness. The *right* is commonly larger than the left, and is situated between the vena cava inferior, and the right crus of the diaphragm, contiguous to the right renal artery. The *left* is placed between the left crus of the diaphragm, and left renal capsule, near the pancreas. These are connected by numerous filaments, which pass transversely between their inner edges, dividing and joining in their course. About these principal ganglia, between the cœliac and superior mesenteric arteries, are several smaller ganglia called the CŒLIAC, connected with the semilunar, and with each other by cross filaments, from which numerous other filaments pass off: all these filaments form together an intricate web which has been termed the SOLAR PLEXUS.

Sometimes the semilunar ganglia are divided into several smaller ganglia, connected by numerous small filaments.

From the Solar Plexus numerous filaments are continued with the principal arteries, forming junctions with each other, and intermixed with cellular substance. Each of these sets of filaments is called a plexus, and is named according to its course or distribution. The plexuses are

1. HEPATIC PLEXUS. *Pl. hepaticus.* Passes downwards and to the right, accompanies the hepatic artery, and divides into a right and left plexus, which take the course of the divisions of the artery and penetrate the corresponding lobes of the liver. They are joined by filaments from the right pneumo-gastric. It detaches filaments, which form the—

α. *Inferior stomachic plexus*, which is continued with the right inferior gastric artery along the greater curvature of the stomach.

β. *Filaments* to the pylorus, duodenum, and pancreas, accompanying the arteries to these parts.

2. SPLENIC PLEXUS. *Pl. splenicus.* Consists of filaments which accompany and surround the splenic artery, along the pancreas. It furnishes filaments to the pancreas and stomach, and passes then with branches of the splenic artery into the spleen.

3. Superior Mesenteric Plexus. *Pl. mesentericus superior.* Is formed by filaments from the under part of the semilunar ganglia, and from the hepatic and splenic plexus. It accompanies the trunk and branches of the superior mesenteric artery, and is distributed to the small and a part of the large intestines, and to the pancreas.

4. Renal Plexus. *Pl. renalis.* Formed by five or six filaments from the upper and lateral part of the semilunar ganglion on each side, and increased by filaments from the superior mesenteric plexus. It accompanies the renal artery, is intermixed with small ganglia, and distributes its filaments to the kidney and renal capsule. This plexus is connected by filaments with the inferior thoracic and superior lumbar ganglia.

5. Spermatic Plexus. *Pl. spermaticus.* Is formed by filaments from the renal plexus, joined by others from the superior mesenteric plexus. It descends with the spermatic vessels, furnishes filaments to the ureter, and is continued in the male to the testicle; and in the female to the ovary.

6. Aortic Plexus. *Pl. aorticus.* Is formed by filaments, which are continued from the superior mesenteric plexus along the aorta, joined by branches from the lumbar ganglia.

7. Inferior Mesenteric Plexus. *Pl. mesentericus inferior.* Is formed by filaments continued from the last-mentioned plexus, which, intermixed with ganglia, accompany and form a web about the inferior mesenteric artery; and are distributed to part of the colon and to the rectum.

8. Hypogastric Plexus. *Pl. hypogastricus.* The filaments from the aortic plexus descending into the pelvis, and joined by filaments from the lumbar and sacral nerves, and from their connecting branches, form this plexus. It accompanies the pelvic vessels, and distributes twigs to the rectum and bladder; in the male to the prostate gland and vesiculæ seminales; and in the female to the uterus and to the vagina.

§ 7. TABLE OF THE NERVES.

I. Nerves from the Brain.

1. Olfactory. Dividing into—
   Branches to the Schneiderian membrane.

2. Optic. Forms the retina.

3. Common Oculo-muscular. Its branches are

  1. To the levator oculi and levator palpebræ superioris.
  2. Branch to the musc. adductor oculi.
  3. Branch to the musc. depressor oculi.
  4. Branch to the musc. obliquus inferior oculi.
  5. Branch to the lenticular ganglion.
    From the lenticular ganglion are given off—
      Ciliary nerves.

4. Inner Oculo-muscular. To the obliquus superior oculi.

5. Trigeminal. Forms the semilunar ganglion, and is divided into three branches, viz.

a. ophthalmic. Its branches are
  1. Supra orbitar.
  2. Nasal, giving off—
    α. Branch to the lenticular ganglion.
    β. Ethmoidal.
  3. Lachrymal.

b. superior maxillary. Its branches are
  1. Malar.
  2. Alveolar.
  3. Spheno-palatine.
  4. Pterygoid, giving off—
    α. Superficial, joining with the facial nerve.
    β. Deep, joining with the sympathetic nerve.
  5. Palatine.
  6. Infra-orbitar.

c. inferior maxillary. Its branches are
  1. Deep temporal.
  2. Masseterine.
  3. Buccal.
  4. Pterygoid.
  5. Temporal.
  6. Dental.
  7. Lingual.

6. Outer Oculo-muscular. To the musc. abductor oculi, and gives off—
  Branches which join with the sympathetic.

7. AUDITORY. To the membrane of the labyrinth of the ear.

8. FACIAL. Its branches are

   1. Chorda tympani.
   2. To the auricle and parts about the angle of the jaw.
   3. Temporal.
   4. Superior facial.
   5. Middle facial.
   6. Inferior facial.
   7. Descending.

9. GLOSSO-PHARYNGEAL. To the pharynx and tongue.

8. PNEUMO-GASTRIC. Its branches are

   1. Pharyngeal.
   2. Laryngeal, divides into—
      - *a.* External branch.
      - *β.* Internal branch.
   3. Filaments passing upon the carotid artery.
   4. Cardiac.
   5. Recurrent.
   6. Pulmonary.
   7. Œsophageal.
   8. Coronary of the stomach.

9. LINGUAL. Its branches are

   1. Descending.
   2. To the tongue and its muscles.

II. NERVES FROM THE SPINAL MARROW. Consisting of thirty-one pairs.

ACCESSORY.
SUB-OCCIPITAL.

CERVICAL NERVES.

Consist of seven pair, viz.—

FIRST CERVICAL. Its branches are

   1. Anterior, forming branches of communication.
   2. Occipital.

SECOND CERVICAL. Its branches are

   1. Anterior, dividing into
      - *a.* Superficial of the neck.
      - *β.* Small occipital.
   2. Posterior, forming branches of communication.

THIRD CERVICAL. Its branches are
  1. Anterior.
  2. Posterior.

DIAPHRAGMATIC NERVE. Formed by branches from the second, third, and fourth cervical nerves.

FOURTH CERVICAL
FIFTH
SIXTH } form the axillary plexus.
SEVENTH
FIRST DORSAL

BRANCHES FROM THE AXILLARY PLEXUS :—

1. THORACIC.
2. SCAPULAR.
3. ARTICULAR.
4. INNER CUTANEOUS.
5. INNER SMALL CUTANEOUS.
6. OUTER CUTANEOUS.

7. RADIAL. Its branches are
  1. To latissimus dorsi and triceps muscle.
  2. Cutaneous.
  3. To supinator longus and extensors.
  4. Superficial giving off—
    α. Palmar.
    β. Dorsal.
  5. Deep branch.

8. MEDIAN. Its branches are
  1. To pronator teres, and the flexors of the hand.
  2. Interosseous.
  3. Palmar.
  4. To the thumb and fore finger.
  5. To the fore and middle finger.
  6. To the middle and ring finger.

9. ULNAR. Its branches are
  1. To the flexors of the hand and fingers.
  2. Cutaneous.
  3. Dorsal.
  4. Superficial palmar, giving off—
    α. Branches to muscles of little finger.
    β. Branch to little finger.
    γ. Branch to ring and little finger.
  5. Deep palmar.

THORACIC NERVES.

Consist of twelve pair. Their branches are

1. POSTERIOR, to the muscles near the spine.
2. ANTERIOR, to the intercostal muscles, &c.
3. INTERCOSTO-HUMERALES, from the second and third.

LUMBAR AND SACRAL NERVES.

Both consist of five pairs which communicate and form the crural plexus. Their branches are

1. DORSAL, to the muscles near the spine and sacrum.
2. EXTERNAL SPERMATIC, from the first and second lumbar
3. BRANCHES to the psoas, quadratus, &c. from the first and second lumbar.
4. EXTERNAL CUTANEOUS, from the third lumbar.
5. SUPERIOR GLUTEAL, from the fourth and fifth lumbar.
6. INFERIOR GLUTEAL, from the second and third sacral.
7. COMMON PUDIC, from the fourth and fifth lumbar, and from the three uppermost sacral. It divides into—

    1. Superior branch, forming dorsal of the penis, or the nerve of the clitoris.
    2. Inferior to perineum, rectum, &c.

8. BRANCH to the rectum, organs of generation, &c. from the third, fourth, and fifth sacral.
9. OBTURATOR, from the second, third, and fourth lumbar.
10. CRURAL, from the four upper lumbar, giving off—

    1. Superior cutaneous.
    2. Muscular branches.
    3. Inferior cutaneous.

11. ISCHIATIC, from the fourth and fifth lumbar, and from the three uppermost sacral, giving off—
    1. Twigs to obturator internus, quadratus, &c.
    2. Branch to gluteus maximus.
    3. Branch to biceps, semi-tendinosus, semi-membranosus.
    4. Superior cutaneous.
    5. Inferior cutaneous.

ISCHIATIC NERVE divides into peroneal and tibial.

PERONEAL, its branches are

1. Superficial.
2. Cutaneous.

3. Deep branch, giving off—
    - α. Recurrent.
    - β. Muscular branches.
    - γ. Anterior tibial.

TIBIAL, giving off—

1. Communicating cutaneous.
2. Branches to gastrocnemii muscles, &c.
3. Branches to the deep-seated muscles of the leg.
4. Cutaneous.

TIBIAL NERVE divides into inner and outer plantar.

INNER PLANTAR, its branches are

1. Plantar digital, viz.
    - α. First to great toe.
    - β. Second to great toe and second toe.
    - γ. Third to second and third toe.
    - δ. Fourth to third and fourth toe.

OUTER PLANTAR, its branches are

1. Plantar digital, viz.
    - α. Fifth to fourth and little toe.
    - β. Sixth to little toe.
2. Deep.

SYMPATHETIC NERVE.

Its ganglia, with the branches of the sympathetic connected with these, are

1. SUPERIOR CERVICAL GANGLION. Branches from it are

    1. Superior. Join with external oculo-muscular and pterygoid branch of the trigeminal.
    2. External. Join with sub-occipital, and first, second, third, and fourth cervical.
    3. Anterior, consisting of
        - α. Superior. Join with lingual, pneumo-gastric, and facial.
        - β. Inferior.
        - γ. Superficial cardiac nerve.
    4. Inferior.

2. MIDDLE CERVICAL GANGLION. Branches from it are
    1. External. Join with fourth, fifth, sixth, and seventh cervical.

2. Internal. Join with recurrent laryngeal.
3. Anterior. Form deep cardiac nerve.
4. Inferior.

3. INFERIOR CERVICAL GANGLION. Branches from it are

1. External. Join with undermost cervical and first dorsal.
2. Internal. Join with nerves of pulmonary plexus.
3. Anterior. Form small cardiac nerve.

4. THORACIC GANGLIA. Branches from them are

1. Branches of connection with each other.
2. Branches of connection with dorsal nerves.
3. Branches from the first thoracic ganglion, connected with the pulmonary and cardiac plexus.
4. Splanchnic, formed by filaments from the sixth, seventh, eighth, ninth, and tenth.
5. Lesser splanchnic.

5. LUMBAR GANGLIA. Branches from them are

1. Branches of connection with each other and last dorsal.
2. Branches of connection with lumbar nerves.
3. Branches of connection with aortic plexus.

6. SACRAL GANGLIA. Branches from them are

1. Branches of connection with each other and with the last lumbar nerve.
2. Branches of connection with sacral nerves.
3. Branches to hypogastric plexus.

7. SEMILUNAR AND CŒLIAC GANGLIA, forming solar plexus, from which are derived:
1. Hepatic plexus, giving off—
   α. Inferior stomachic plexus.
   β. Filaments to pylorus, duodenum, pancreas.
2. Splenic plexus.
3. Superior mesenteric plexus.
4. Renal plexus.
5. Spermatic plexus.
6. Aortic plexus.
7. Inferior mesenteric plexus.
8. Hypogastric plexus.

SECTION VI.

THE DISSECTION OF THE ORGANS OF THE SENSES.

CHAPTER I.

Of the Eye.

The Organ of Vision, situated within the orbit, consists of the globe of the eye and its appendages.

§ I. OF THE APPENDAGES.

The Appendages are—

Eyebrows. *Supercilia.* Are slight eminences of the common integuments, somewhat arched in figure, placed on the superciliary ridges, and covered by short hairs, the roots of which are towards the nose, whilst their points are directed outwards.

Eyelids. *Palpebræ.* The upper eyelid begins from the eyebrow, is larger, and, when depressed, nearly covers the anterior part of the eye. The under and smaller eyelid begins from the cheek. The eyelids have the skin upon them furrowed. They are joined, and form angles at their extremities, distinguished by the names of *inner* and *outer canthus*. The lids are formed by a fold of common integument, which at this part is extremely thin. In each of them there is found a thin semicircular fibrous layer, approaching to cartilage, called the *tarsus*, and the upper tarsus is broader than the lower. They are closely united to the edges of the orbit, especially at the outer side, by an expanded *ligamentous substance.* To the inner side they terminate at a little distance from the inner angle, and are connected by the tendon of the orbicularis palpebrarum. At the

edges of the eyelids are placed several rows of stiff hairs, called the

Eyelashes. *Ciliæ.* Those of the upper eyelid are bent upwards, and are longer than those of the under eyelid, which are bent in the opposite direction: in both they are wanting near the inner angle.

Tunica Conjunctiva, or *Adnata.* Is a thin membrane, which, as its name implies, connects the globe with the eyelids. It may be said to begin at the edge of the upper eyelid, and to line it internally: it is then reflected upon the globe, covers its anterior surface, and passes upon the under eyelid, terminating at its edge. Just behind the caruncula lachrymalis, in quitting the globe at the inner canthus, it forms a fold, sometimes scarcely marked, called the *valvula semilunaris.*

This membrane has apparently a similar texture with that of the mucous membranes; but it is so thin as to show the parts underneath. It is connected by rather a loose cellular texture to the sclerotica; but on the transparent cornea adheres so firmly, that it cannot be separated by the scalpel. It differs further, where it covers the transparent cornea, in being thinner, more transparent, more polished, and less vascular.

Between the tunica conjunctiva which lines the eyelids, and the tarsi, are placed a row of sebaceous follicles, called the *glandulæ tarsi*, or *Meibomii.* They appear like a series of parallel white lines, running in a serpentine direction, and some joined together. From the openings of these, *puncta ciliaria*, a sebaceous matter may be expressed, which is the secretion for the lubrication of the eyelids.

Caruncula Lachrymalis. At the inner angle of the eye, between it and the globe, is situated the *caruncula lachrymalis.* It is of a conical figure, and of a red colour, from the conjunctiva being reflected over it. It consists of a cluster of small mucous glands, with minute hairs about their orifices. The *valvula semilunaris* is a doubling of the conjunctive coat, between the caruncula and ball of the eye. In quadrupeds, but still more remarkably in birds, it is of large size, called the membrana nictitans, and by means of a muscular apparatus may be drawn before the eye for its protection.

All the parts above-mentioned may be seen without dissection, but that is not the case with those which follow:

Lachrymal Gland. *Glandula Lachrymalis.* Formerly called the *gland. innominata*, is a conglomerate gland, of a yellowish colour, of an oval, flattened form, and about the size of a small almond. It is situated in the hollow of the orbitar process of the os frontis, at the anterior and outer part of the orbit; it cannot be well seen till the orbit be dissected.

It is surrounded by adipose membrane, but is firmly connected to the periosteum of the orbit above. It has several extremely small *excretory ducts* which pass from the gland and terminate upon the surface of the conjunctiva, near the outer angle of the eye and edge of the upper eye-lid.

PUNCTA LACHRYMALIA. At the inner angle of the eye are the *puncta lachrymalia;* two small orifices, one in the upper, the other in the under eyelid, at the extremity of the tarsus, marked by an eminence at that part and opposite to each other. They are very distinct in the living subject, but not so readily distinguished in the dead. The puncta are the orifices of two *canals,* which run in the direction of the edges of the eyelids, towards the side of the nose. They are somewhat larger than the puncta. The *upper* passes vertically upwards for the space of a line, then turns at right angles downwards. The *lower* is first vertical, then nearly horizontal. They terminate together, but sometimes separately, at the upper and outer part of the lachrymal sack. They are best dissected after having passed bristles into their orifices.

LACHRYMAL SACK AND DUCTUS AD NASUM. The *lachrymal sack* is the cavity into which the tears are received; it is of a somewhat oval form, terminating above in a blind extremity: and, tapering inferiorly, is continued with the ductus ad nasum. It is situated in the lachrymal fossa, formed by the nasal process of the superior maxillary bone and the os unguis, which forms only a thin partition between it and the nose. It is immediately behind the tendon of the orbicularis muscle, above which about a fourth part is situated, and about the eighth of an inch behind the edge of the orbit. It is covered also externally by the skin, the orbicularis palpebrarum, and (towards the eye) by the caruncle and conjunctiva, which parts must be removed to see it; it is strengthened by an aponeurosis from the tendon. The parietes are formed by a white, dense, tendinous-like membrane, and by a lining of mucous membrane continued from the pituitory membrane of the nose. At its outer and upper part are the orifices of the puncta.

The *ductus ad nasum* is continued from the sack. It is formed by a canal in the maxillary and spongy bones, and terminates below the inferior turbinated bone. Its direction is obliquely downwards and outwards, forming a slight bend anteriorly. When the sack has been opened, if a probe be introduced and the stem of it rested against the superciliary ridge, that will give it the exact direction of the duct into the nose, and this may be followed by chipping away the nasal process of the superior maxillary bone. It is lined by mucous membrane, and its orifice has generally a fold of

membrane. It is about an inch in length, and the eighth of an inch in diameter.

Next proceed to dissect the more immediate

CONTENTS OF THE ORBIT.

These are the muscles, vessels, and nerves of the eye, with the eye itself and a quantity of adipose matter.

In order to dissect these, saw out a triangular portion of the orbitar plate of the os frontis, with its apex extended to within a quarter of an inch of the optic foramen; turn it forwards and upwards, but do not cut it away from the skin of the forehead. When this has been done a dense membrane is seen completely lining the orbit, but it is merely the periosteum, which is not very closely connected to the bone. Make a section of it similar to that through the bone and you will expose the levator palpebræ superioris which is narrow behind and broad before, where it is attached to the tarsus of the upper eyelid. Upon it is seen the supra orbitar artery and nerve running forwards to their distribution. Immediately under the outer angular process of the os frontis is placed the lachrymal gland embedded in fat. Turn the levator palpebræ aside and observe beneath it the levator oculi. On the outer side of the orbit, the abductor oculi is seen passing forwards, and having the lachrymal nerve on its upper edge which runs to the gland. On the inside the superior oblique muscle is seen with its tendon passing through the little pulley, and below it the adductor oculi: between these two muscles the nasal nerve and artery pass forwards to their destination.

Next cut away the outer angular process of the os frontis and the superior orbitar process of the malar bone. At the posterior part of the orbit will then be seen the origins of all the muscles, except the inferior oblique, surrounding the optic nerve in its passage through the foramen, and the distribution of the common, inner, and outer oculo muscular nerves; the nasal branch of the opthalmic division of the fifth will also be seen forming on the outer side of the optic nerve, with a branch of the common oculo muscular, the lenticular ganglion, from which the ciliary nerves may be traced into the globe of the eye. The nasal branch will afterwards be seen passing between the optic nerve and the levator oculi to the inside of the orbit. At the under part the depressor oculi passes to its attachment. To see the inferior oblique muscle in its situation, make a horizontal incision through the skin of the lower eyelid outwards, beginning it from the junction of the malar and maxillary bones. In performing this dissection great care is required in taking away the fat and cellular membrane, lest the nerves should be also removed. The preceding description will suffice for the situation of the muscles in the

Ocular Region, which consists of seven.

1. M. Levator Palpebræ Superioris.

Origin. From the back part of the orbit near the upper margin of the foramen opticum. It passes forwards, becoming broader in its passage.

Insertion. By a broad thin tendon into nearly the whole length of the cartilage of the upper eyelid.

2. M. Levator Oculi.

Origin. From the upper margin of the foramen opticum of the sphenoid bone, below the levator palpebræ superioris.

Insertion. By a broad thin tendon into the superior and fore part of the tunica sclerotica.

3. M. Depressor Oculi.

Origin. From the lower part of the foramen opticum.

Insertion. Into the tunica sclerotica, opposite the former.

4. M. Adductor Oculi.

Origin. From the inner part of the foramen opticum, between the obliquus superior and depressor oculi.

Insertion. Into the inner and fore part of the sclerotic coat.

5. M. Abductor Oculi.

Origin. From the bony partition between the foramen opticum and foramen lacerum.

Insertion. Into the outer and fore part of the sclerotic coat.

6. M. Obliquus Superior.

Origin. From the edge of the foramen opticum, between the levator and adductor. It runs along the flat plate of the ethmoid bone to the upper part of the orbit, where a cartilaginous trochlea is fixed to the inside of the internal angular process of the os frontis, through which its tendon passes; then runs outward and downward, enclosed in a loose membranous sheath.

Insertion. Into the tunica sclerotica, midway between the insertion of the levator oculi and the entrance of the optic nerve.

7. M. Obliquus Inferior.

Origin. By a narrow beginning from the outer edge of

the orbitar process of the superior maxillary bone, near its juncture with the os lachrymale; and runs obliquely outwards.

Insertion. Into the sclerotica by a broad thin tendon between the abductor and the optic nerve.

The tendons of these muscles are seen through the tunica conjunctiva, so as to give a brilliant appearance to that which, in common language, is called the white of the eye, and anatomically, in contradistinction to the transparent part, the opaque cornea.

The *Uses* of the first five muscles are described by their names; of the latter, the *superior oblique* raises the globe upwards and inwards; and the *inferior* draws it downwards and inwards.

§ 2. OF THE STRUCTURE OF THE GLOBE.

In order to examine the Eye properly, it must be removed from the orbit, and cleared of the muscles and fat.

The Globe of the Eye is nearly spherical, except where broken by the projection of the transparent cornea. Its prominence is owing to a cushion of fat, which, together with cellular membrane, fills up the orbit. It is composed of tunics and humours, together with the vessels and nerves. The tunics are commonly reckoned as three: viz. 1. *Sclerotica*, 2. *Choroides*, 3. *Retina*. But to these are sometimes added the cornea transparens and iris. The humours are also three in number: viz. 1. *Vitreous*, 2. *Crystalline*, 3. *Aqueous*.

Tunica Sclerotica. Is the strongest coat of the ball of the eye. It is dense and thick, not divisible into layers, but composed of a number of fibres, interlaced together, and crossing each other in all directions. It is thickest posteriorly; strengthened anteriorly by the tendons of the muscles, which give it a dense white appearance called *cornea opaca;* and pierced by small holes for the transmission of nerves and vessels. Posteriorly, it has an opening, through which the optic nerve passes. This aperture is not in the direction of its axis, but situated towards the inner side.

On the fore part it is defective, and its place is supplied by the *cornea transparens.* This occupies about the anterior fifth of the globe; projects from the surface of the sclerotic; is circular; and its circumference intimately connected, by means of an oblique edge, with the sclerotic. It is hard, dense, and transparent, but thinner than the sclerotic, and may be separated into a number of lamellæ.

The rest of the dissection must be carried on in water, as the tunics are thereby more readily separated from each other. Dr. Jacob recommends fastening the eye upon a piece of wax, attached to a flat portion of ground glass, which is to be immersed in water. He also employs a hollow glass sphere, a fourth part of which is cut off, and its edges ground to fit the flat plate; this being filled with water and whelmed over the part to be examined, gives great distinctness to the object, as it answers the purpose of a strong lens.

Cut round the sclerotic coat carefully, remove it, and expose beneath, the

Tunica Choroides. Which begins at the entrance of the optic nerve into the eye, lines the internal surface of the sclerotic passing between it and the retina, and terminates at the ciliary ligament, to which it is firmly connected. The internal surface of the membrane is lined by a deep brown or black pigment, called the *pigmentum nigrum*, which, in the dead subject at least, penetrates the membrane, and tinges the sclerotic coat on the opposite side, but not the retina. It is in greater abundance on the anterior than on the posterior part, and the colour varies, somewhat according to the complexion and age of the individual. If the tunic be macerated, and the dark substance to which also its substance owes its colour removed, it becomes in a great measure transparent, and appears to be made up of vessels disposed in little bundles, connected by cellular membrane; those on the outside, disposed in whirls, are veins, called *vasa-vorticosa;* those on the inside run more parallel to each other, and are the ramifications of the *ciliary arteries.* Hence Ruysch was led to conceive, that the coat was composed of two lamellæ.

At the fore part, where the choroid seems to terminate, is a whitish line called the

Ciliary Ligament. It bounds the choroid, and gives attachment to it, anteriorly. It is seen when the sclerotic is raised from the choroid coat, at about one-twelfth of an inch behind the part where the opaque joins with the transparent cornea. It is nearly colourless; and is not of a ligamentous nature, but seems formed of a quantity of condensed cellular substance. It adheres to the sclerotica, but not firmly, and likewise gives attachment to the iris.

Take another eye, cut vertically through the globe, remove the humours, and expose the

Corpus Ciliare and Processus Ciliares. At the fore part of the choroid and opposite the ciliary ligament, there will be seen a black radiated ring, which is the *corpus ciliare.* The blackness is owing to the same dark substance as that on the choroid coat. This pigment is next to be washed off gently. Then behind the iris, and before the choroid, there will be observed a number of membranous folds, forming a ring, disposed like rays, narrower at the extremities, larger in the middle, and extended from the choroid to the edge of the pupil. These radiated folds begin some way on the choroid, and are covered by the pigment, which is most abundant in the interspaces. These folds are applied upon the capsule of the vitreous humour and canal of Petit: and upon them, after the ciliary processes have been separated, is left the black pigment from the interspaces. These processes are continued over the edge of the lens; their anterior extremities, called the *processus ciliares*, are unattached and floating in the aqueous humour of the posterior chamber.

Iris. Is the membrane seen through the cornea, and on which the apparent colour of the eye depends. It forms a circular flattened ring. The greater circumference of which is attached to the ciliary ligament, a little behind the junction of the sclerotic coat with the transparent cornea. It forms a septum in the anterior part of the eye, dividing it into two cavities. It is perforated in the centre, forming the *pupil*, or that part through which the rays of light are transmitted to the interior of the globe. Upon its back part is a dark-coloured pigment, which, from its resemblance in colour to the grape, was formerly called the *uvea.* Its colour depends upon this pigment; for, when it is removed, the iris seems colourless. When the pigment is cleared away, the iris seems to be made up of radiated fibres; and some anatomists have described a set of circular fibres surrounding its inner edge.

Dr. Jacob has given a very interesting paper in the 12th vol. of the Med. Chir. Trans., upon the Structure of the Eye, in which he speaks of the Iris. He states, that, on the *front* of the iris, there are "a number of irregularly shaped masses," which he presumes answer the same purpose as the *carneæ columnæ* of the heart, from the convexities of which "a number of elevated lines, equally irregular in size and number, proceed toward the pupil, and attach themselves at the distance of about a twentieth of an inch from its margin, and from this point of attachment a number of much smaller *striæ* converge to the central opening;" and these he believes are similar to the *chordæ tendineæ.* By this apparatus he accounts for the dilatation of the pupil. The contraction of it, he accounts for, by what has been always considered as the constrictor or orbicular muscle, which surrounds the pupil; "by a well defined distinct circle about the twentieth part of an inch in diameter and of a denser structure than the rest of the iris," which is best seen from behind by washing off the uvea.

Cut round the choroid coat and expose the

Membrana Jacobi. Which separates the choroid from the retina: it has lately been discovered by Dr. Jacob. It extends from the optic nerve as far as the ciliary processes; is of a uniform villous structure, and more or less tinged by the black pigment. Beneath it is found the

Retina. Is the third membrane. The optic nerve, in its continuation through the orbit, is covered by elongations of the dura and pia mater, as far as its passage through the coats of the eye. At the back part of the ball of the eye, and a little removed from the axis toward the nose, its fasciculi pass through the sclerotic, and through the choroid coat. It contracts at its passage through the sclerotic, and immediately afterwards expands and forms the retina; which extends between the choroid coat and capsule of the vitreous humour, but does not adhere to either. Arrived at the ciliary body, the retina appears to terminate; but a thin layer is continued under the ciliary processes which is known as the *ligament* of the retina. This may be seen by cautiously raising the choroid coat and ciliary processes in water, leaving this portion of the retina, which is very thin, upon the vitreous humour. The texture of this membrane resembles medullary substance, as far as it is tender and pulpy, and of a light grey colour; but it is semi-transparent.

Soemmering has discovered in the retina, at one-sixth of an inch outwards from the entrance of the optic nerve, directly in the axis of the eye, a central hole of a dark colour, with a yellow border, becoming paler towards the circumference. Close to it is a fold from the insertion of the optic nerve, extending about one-sixth of an inch outwards.

OF THE HUMOURS.

The Humours of the Eye are each contained in proper capsules of their own.

1. Vitreous Humour. Is the largest in quantity of the humours, filling the posterior part of the globe, and occupying more than three-fourths of the eye. It is convex on all sides, except anteriorly, where it lodges the crystalline

lens. It is pellucid, and thicker than the aqueous, being viscid or gelatinous in consistence. It is enclosed within a very delicate membrane, called *tunica vitrea, (aranea, hyaloidea,)* which, like the humour, is quite transparent. This tunic sends processes within, forming cells, in which the humour is contained: as may be seen after boiling, or congelation, or by the action of acids. These cells communicate: so that, if a puncture be made, the humour oozes out through it.

At the edge of the crystalline, the tunica vitrea divides into two laminæ; the one of which gives an anterior covering to the lens, and the other passes behind it. By their separation a canal is formed, which passes around the crystalline lens, and is called the *canal of Petit.* It contains no fluid; and its two laminæ, which are closely applied to each other, may be rendered distinct by inflation. The anterior lamina is called *membranula coronæ ciliaris,* or *zonula ciliaris,* and has a striated appearance, in a circular form into which are received the folds of the corpus ciliare.

2. Crystalline Lens. Is a transparent body, named from its lenticular form, with two convex surfaces, the anterior of which is less convex than the posterior; being formed of segments of spheres of unequal size. It is situated opposite to the pupil, behind the aqueous humour; and its posterior part is received into a depression on the fore part of the vitreous humour. The external part of the lens is of a soft gelatinous consistence; but it becomes denser and firmer towards the centre. The central part is composed of concentric lamellæ. This is apparent on simple inspection, but is rendered much more distinct by maceration in some astringent fluid or boiling water. The lamellæ have numerous striæ on their surfaces, which pass like radii from the centre to the circumference: they seem, therefore, to be of a fibrous structure.

The lens is surrounded by a *proper membrane,* which completely envelopes it. It is quite pellucid, is thicker than the tunica vitrea, and has been compared in structure to the cornea. It is situated between two layers of the tunic of the vitreous humour. Between the lens and its capsule is a small quantity of aqueous fluid, (*liquor Morgagni,*) which flows out as soon as the capsule is opened.

3. Aqueous. Is contained in the space between the cornea and crystalline lens. This space is divided into two cavities by the iris, called the *chambers.* The anterior,

and by much the larger, is situated between the cornea and iris; and the posterior, between the iris and crystalline lens. The capacity of the chambers is best seen by freezing the eye. The aqueous humour is a perfectly pellucid, but slightly viscid, liquor.

The membrane of the aqueous humour may easily be seen either by scraping the inside of the cornea, or by immersing it in boiling water.

× which are situated opposite

CHAPTER II.

Of the Mouth, and Parts connected with it.

The Mouth is formed, anteriorly, by the lips; behind, by the velum palati and the opening to the pharynx; above, by the palatine vault; below, by the tongue and membrane of the mouth; on the sides, by the cheeks.

The bony parts are the ossa maxillaria superiora, the ossa palati, the maxilla inferior, and the teeth. The soft parts are, the lips, cheeks, gums, palate, tongue, membrane lining the mouth, and salivary glands.

Lips and Cheeks. The *lips* are distinguished by the name of *superior* and *inferior*. They terminate by an edge, more or less thick, which is remarkable for its red colour, when compared with the neighbouring skin. They are united at the outer angles, by the *commissures*. Externally, the superior has a longitudinal depression from the septum of the nose, called the *filtrum*. Internally, they are covered by the membrane of the mouth, which about the middle forms a fold, named the *frænum*, connecting each lip to the corresponding maxillary bone. Upon the edges of the lips, which are covered by a continuation of the membrane of the mouth, are numerous fine villi, which may be distinguished after a fine injection, and the removal of the cuticle by maceration. The lips and cheeks are formed of muscles, common integuments, membranes, glands, and their vessels and nerves. Between the masseter and buccinator, the space is occupied by a large quantity of fat. The *glands* of the lips and cheeks are small rounded bodies, situated beneath the internal membrane in considerable number. They have each an *excretory duct*, by means of which they pour out a viscid fluid to lubricate the adjacent parts. Those on the lips are named the *labial glands*—those on the cheek, the *buccal*.

Tongue. Occupies the space of the arch of the inferior maxilla between the teeth. It is divided into its *body*, *base*, and *apex*. On the body are distinguished an upper and an under surface, and two sides or edges. The *upper surface*, or *dorsum*, is divided into two equal halves, by a *linea mediana*, or middle groove, called sometimes the *raphe*, running longitudinally. The *inferior surface* is, anteriorly, smooth from its covering, which is a continuation from the membrane of the mouth. It is divided by a longitudinal depression, which separates the projection of the muscles; its posterior half is connected to the parts below, by the sublingual ligament, or *frænum linguæ*, which is a triangular fold of the lining membrane. The *sides* of the tongue are thicker posteriorly than anteriorly; they are round and smooth; and are fixed to the lower jaw, the styloid processes, and the parts adjacent, by membranous ligaments. The *apex*, or tip, is movable, and more or less rounded. The *base*, or posterior part of the tongue, is connected to the os hyoides, and by the medium of this to the adjacent bones and muscles, as also to the epiglottis and the anterior pillars of the fauces.

The tongue is chiefly composed of *muscular fibres*, which are in part derived from the muscles which serve for its motions. These are the M. linguales, stylo-glossi, genio-glossi, and hyo-glossi. The muscular fibres of the substance of the tongue form by their interlacement a network so intricate as to preclude the possibility of unravelling its fibres. These fibres are united by a very fine and close cellular texture, in which some fat is found.

The tongue is covered by a *membrane*, which is continuous with that of the mouth, and is similar to the common integuments. The cutis vera is plentifully supplied with nerves, and covered with small projecting bodies, called the *papillæ*, dispersed over the upper surface of the tongue. They are divided into three kinds:—the capitatæ, lenticulares, and conicæ.

The *P. capitatæ* (maximæ, lenticulares, vallatæ) are the largest; and, as their name implies, have a rounded head, with a short stem. They are placed at the base of the tongue, in superficial fossulæ, and the whole are arranged in such a way as to form an angle, with its point backwards. Their number and size vary. Their head has a cup-shaped depression. They are of a firm consistence, and seem formed of the ramifications of blood-vessels and nerves, united by cellular texture.

The *P. lenticulares* (semi-lenticulares, mediæ, fungiformes) are smaller than the former, and are scattered over the whole surface of the tongue, at some distance from each other.

The *P. conicæ* (minimæ, villosæ) are the smallest and most numerous. They occupy almost the whole upper surface of

the tongue, but are most abundant towards the apex; are connected by their bases to the tongue; but having the apices free. The posterior are the larger, and their direction perpendicular; the anterior and smaller, are somewhat inclined and more movable.

The papillæ are formed principally by the filaments of the lingual branch of the fifth pair of nerves, which terminate by minute points, surrounded by a network of vessels.

At the root of the tongue, besides the papillæ, are numerous *mucous follicles.* Behind the angle formed by the papillæ capitatæ, is an orifice, likewise of a mucous follicle, called from its first describer, the *foramen cœcum of Morgagni.*

The SALIVARY GLANDS have already been described. The *Parotid Gland,* p. 176; the *Submaxillary Gland,* p. 184; and the *Sublingual Gland,* p. 186.

CHAPTER III.

Of the Nose, and Parts connected with it.

§ 1. OF THE NOSE.

The Nose is divided into an *external* prominent part, and an *internal* formed of two cavities.

External Part. Is of a pyramidal figure.—On its outside we distinguish:—the *radix*, or upper part; the *dorsum*, or middle prominence; the *apex*, or point; the *alæ*, or lateral movable parts; the *columna*, or under part of the partition next the upper lip, which separates two openings, called the *nostrils*, leading to the internal cavities, about which are some small hairs, called *vibrissæ*. It is composed superiorly of bone, and inferiorly of cartilage. It has a partial covering of muscle, and a general one from the common integuments. It is lined by a mucous membrane.

Cartilages. Are one large single one which assists in forming the septum of the nose, and four smaller ones situated at its sides, viz.

1. Cartilage of the Septum. Is the middle and most considerable cartilage; of a somewhat triangular figure. Its base or superior edge is joined to the anterior edge of the nasal lamella of the ethmoid bone. The inferior edge is received within the two edges of the vomer. The anterior edge forms the dorsum of the nose, and is united with the lateral cartilages. It is very thick above, but becomes gradually thinner as it descends, and terminates by a short rounded edge, which projects between the cartilages of the alæ.

2 & 3. Lateral Cartilages. Are two in number, extending from the middle cartilage. They are placed somewhat obliquely at the side of the nose, and are connected by short ligamentous fibres to the edge of the nasal bones and

nasal process of the superior maxillary bones, and to the cartilages of the alæ by a ligamentous substance. They are of a triangular figure, and externally more or less convex.

4 & 5. CARTILAGES OF THE ALÆ. Are two in number. Their shape is irregular, but so as to form the greater part of an oval, being composed of two branches united in front. Between the lateral and the alar cartilages are small cartilaginous bodies, of which the number, size, and figure vary.

Having attended to these points, it will be proper to make a section of the head, in order to display the internal parts of the nose, together with the cavities and openings connected with them. For this purpose the one half of the lower jaw should be removed; and in so doing it should be carefully detached from the parts connected with it. The next object will be to cut out a suitable portion of the bones of the head and face: it may be done (after having removed the brain) by applying the saw to one side of the crista galli, on a line drawn from the os frontis to the sella tursica, then sawing perpendicularly through the frontal, sphenoid and ethmoid bones into the cavity of the nose, on the same side, and the bony palate and palatine bone are to be sawed through from below in the same direction. The saw is next to be applied at a point on the parietes of the cranium, corresponding to the anterior edge of the glenoid cavity, and a cut is to be made which shall meet the first at the sella tursica, and is then to be carried perpendicularly through the basis of the cranium. These cuts will insulate a triangular portion of the bones of the head and face. Their removal will give an opportunity of examining several parts requiring notice, viz.—The extent and form of the cavities of the nose.—The openings into each from the lachrymal sack, the antrum maxillare, the frontal, ethmoidal and sphenoidal sinuses.—The passage of the fauces with its pillars, the uvula, the situation of the tonsils, and the mechanism of the velum pendulum palati.—The extent and form of the pharynx, with the situation and relation of the openings into it from the nose, mouth, ears [Eustachian tubes,] larynx, and œsophagus.—The form of the posterior part of the tongue.—The mechanism and situation of the epiglottis.

INTERNAL PART OF THE NOSE. Comprehends the internal nares or cavities of the nose. These cavities have an irregular form, and are divided by the septum. Their greatest extent is from behind to before; and their breadth is the least considerable dimension. Their direction is a little oblique from before hindwards. They are formed, above, by the crybriform plate of the ethmoid bone in the middle, by the bones of the nose anteriorly, by the sphenoid bone behind; and below, by the horizontal portions of the maxillary and palatine bones. To the outer side they present an irregular surface, formed by the ethmoid and inferior turbinated bones, which make two projections, and divide the external part into three meatus, or passages:—1. *Meatus narium superior*, which is the smallest, is placed at the upper, inner, and back part of the turbinated plate of the ethmoid bone:—2. *Medius*, between the turbinated plate of the ethmoid and the turbinated bone:—3. *Inferior*, between the turbinated bone and the floor of the nose.

Mucous Membrane of the Nose. The inside of the nose is lined with a thick, soft, and spongy membrane, the *membrana mucosa*, (pituitaria, Schneideriana.) This not only covers the internal parietes of the nose, but is continued into the different cavities connected with the nose. It is redder than the other mucous membranes. It is thin where lining the external nose, it is thicker in the nasal cavities, and diminishes again in the sinuses. The spongy texture is most remarkable on the turbinated bones. On its surface are observed numerous minute orifices, as if from the prick of a pin, which are the openings of the *mucous follicles*. No glands can be observed in the membrane, nor distinct villi.

§ 2. OF THE CAVITIES CONNECTED WITH THE NOSE.

There are several cavities or sinuses situated in the bones connected with the nose, and opening into its cavity. The ethmoid bone, it will be recollected, is formed in a great measure of thin plates of bone, so disposed as to form small canals or cells, called the *Ethmoidal Cells* or *Sinuses*. There are two sets of these distinct from each other. The posterior, opening into the superior chamber of the nose; the anterior, having a common canal of communication with the frontal sinuses terminate in the anterior part of the nose in the middle meatus. The *Frontal Sinuses* are cavities in the frontal bone, in its thickest part; they are large below, but become smaller as they ascend; but vary in size, frequently reaching to the orbitar process, and are separated by a middle partition, which is sometimes perforated. The *Sphenoidal Sinuses* are cavities found within the body of the sphenoid bone. Sometimes there is one only. They open behind the posterior ethmoidal cells, into the upper and back part of the nose. The *Maxillary Sinus*, antrum Highmorianum, is situated

in the superior maxillary bone. It is of a conical form; having its base inwards, its apex outwards. It is separated from the orbit; above, by a thin plate, in which is the infra orbitar canal; below, by a thin partition from the alveoli of the molar and bicuspides teeth, so that sometimes the roots of these teeth are found to perforate the septum. It is strengthened on the outer side by the malar projection. When this is raised, the thin layer of bone covering the sinuses, is often broken. Behind, it has the tuberosity of the superior maxilla. Its base corresponds to the nasal cavities, with which it communicates by an opening in the middle chamber; this appears larger than it is found to be, when the bones are separated. At the upper part of this sinus, *appendices* are sometimes found, which communicate with the ethmoid cells. Besides these the *Ductus ad Nasum* terminates in the inferior chamber, about half an inch behind the nasal process of the superior maxillary bone; its orifice has often a loose membranous fold.

These cavities are all lined by a continuation of the pituitary membrane; but in them it is thinner and less vascular than that which lines the cavity of the nose.

§ 3. OF THE PARTS AT THE PASSAGE OF THE FAUCES.

The mouth is bounded posteriorly by the *Velum Pendulum Palati*, or *Palatum Molle*, a kind of curtain which depends from the edge of the ossa palati, and from the pterygoid processes of the sphenoid bone, and forms a partition between the mouth and pharynx. Above, where it is fixed to the bones, it is of considerable thickness. Its inferior part forms an unattached edge; in the middle of which the *Uvula*, or pap of the throat, takes its origin, and hangs over the root of the tongue. This is of a conical shape, and varies in length. The edges of the velum are continued to the tongue and pharynx by two membranous and muscular folds on each side, which singly are called the *Pillars*, and each pair the *Arches of the Fauces*. At the side of the uvula these are close together, but as they descend they separate; so that the anterior pass obliquely, and terminate at the base of the tongue, while the posterior pass nearly perpendicularly, and are lost on the sides of the pharynx. A kind of triangular space is left by their separation, which lodges on each side the *Tonsil Gland*.

These parts are formed by:—a doubling of the mucous membrane, being a continuation anteriorly of the membrane lining the palate; and posteriorly, of the pituitary membrane. The first is the paler, the latter having a considerable degree of redness. Beneath the first are a number of small glands of a yellowish colour, the excretories of which are not distinct. The uvula is also surrounded by these glandular bodies. Beneath the mucous membrane are found muscles; in the middle the azygos uvulæ; in the velum, the expansions of the circumflexus and levator palati; in the anterior pillar the constrictor isthmi faucium; and in the posterior the palato-pharyngeus. The parts are strengthened by their tendinous expansions.

The opening to the pharynx is nearly quadrilateral, bounded above by the arch of the palate, or by the velum, when it is let down; at the sides by the pillars and tonsils; and at the bottom by the base of the tongue. The size of the passage cannot be much enlarged; for when the velum is elevated, the tongue is pressed backward.

Tonsils. Are glandular bodies of a reddish colour, situated in the space between the pillars of the fauces, by the sides of the base of the tongue. They are longest in their vertical diameter, and hence they have been called the *Amygdalæ*, or almonds; but they vary in their figure. They are made up of several lobes which are more or less connected with each other, and are of a soft and pulpy texture. In regarding them from the mouth their surface seems studded with openings of some size, which lead into small cavities, disposed like cells, occupying the interior of the gland. These are more distinct at the upper part, but vary in form and disposition. They generally communicate with each other, so as to give to the gland at that part the appearance of network. They are lined as well as their orifices with the membrane of the mouth, and upon their surface excretory ducts open.

§ 4. OF THE PHARYNX.

Is a large muscular bag in the form of an irregular funnel, with the œsophagus descending from it, and forming its under end. It is bounded above by the cuneiform process of the os occipitis, anteriorly by the pterygoid processes and jaws, and the larynx, with all of which it is connected. Posteriorly it lies upon the cervical vertebræ, and upon the muscles which

cover them, with which it is connected by loose cellular membrane: from the cranium to below the opening into the larynx the two sides are separated; but lower down they are applied to each other except during deglutition. It corresponds laterally to the internal carotid arteries, and the internal jugular veins.

There are seven openings in it, by which it communicates with the neighbouring cavities. At its upper part the *posterior openings of the nares* vertically oblong, separated by the posterior edge of the septum. Beneath these is the velum palati, and below it the *isthmus of the fauces*, the opening of communication between the mouth and pharynx. Lower down the base of the tongue, and then the epiglottis, a movable cartilage belonging to the larynx: this covers the *opening into the larynx*. At the upper and anterior part of the lateral parietes are the openings of the *Eustachian tubes* projecting from the sides, turned forwards and inwards, and seeming rather to open into the nares. The superior extremity of the pharynx forms a blind extremity, and occupies the space between the openings of the nares and the condyles of the os occipitis. The inferior extremity opens into the upper extremity of the *œsophagus* with which it is continuous.

The pharynx is surrounded by a loose cellular membrane which unites it to the surrounding parts. Its *muscular part* is formed of five muscles on each side, described at page 191; M. pharyngeus superior, medius & inferior, stylo-pharyngeus, and palato-pharyngeus. It is lined by a *membrane* which is continuous with that of the nose, of the mouth, larynx, and œsophagus. It is thickest at the upper part; is very thin on the posterior surface of the larynx, and has a plicated appearance. It is covered by a very thin epidermis, and perforated by the *ducts of numerous glands*, situated on its external surface; and which are most abundant at the upper part.

§ 5. OF THE THYROID GLAND.

The thyroid gland is situated at the lower and lateral parts of the larynx and upper and anterior part of the trachæa. It is large in the fœtus, but afterward decreases in size. It is formed of two lobes joined by a narrow slip, sometimes wanting, which crosses the trachæa a few lines below the cricoid cartilage. Sometimes a process from the middle portion, which may be mistaken for a muscle, ascends between the sterno-hyoidei, and is fixed to the base of the os hyoides. The lobes begin at the sides of the cricoid cartilage, and descend a certain way upon the trachæa and œsophagus. They are covered anteriorly by the sterno-hyoidei, the sterno-thyroidei and the omo-hyoidei. The gland is of a reddish brown colour, resembling in appearance the lymphatic glands. It is of a firm consistence. Internally it presents a granulous and often cellular appearance.

(Practical Points.)—Situation, growth, and removal of Polypi from the nose.—Diseases of the antrum maxillare.—Passing a probe into Eustachian tube.—Extraneous bodies lodged about glottis.—Introduction of a pipe (as in suspended respiration) into the œsophagus or opening into the larynx.—Passing bougies into the œsophagus.—Extirpation of tonsils.

CHAPTER IV.

Of the Larynx and its Appendages.

The Larynx consists of several movable cartilages connected by ligaments, together with muscles and membranes, forming a cavity of an irregular figure. It is situated superficially at the upper part of the trachæa, and below the os hyoides, with both which it is connected. Behind it rests on the bodies of the vertebræ and pharynx.

The CARTILAGES are five in number, viz. the THYROID, CRICOID, the two ARYTÆNOID, and the EPIGLOTTIS.

THYROID CARTILAGE. The thyroid, or *shield-like* cartilage, which is the largest of the five, is placed at the upper and fore part of the larynx. It is larger above than below, and its breadth exceeds its length. It consists of two lateral quadrangular portions united in the middle at an angle more or less acute, which may be felt beneath the integuments. This is more prominent in men than in women, and is called the *pomum Adami*. The upper part of this angle is formed into a *notch*. The lateral portions, or *alæ*, have a plane, or but slightly concave, surface, covered principally by the M. thyreo-hyoidei. An oblique and projecting line extends upon this surface, and gives attachment to the M. sterno-thyroideus & constrictor pharyngis inferior.

These surfaces are terminated by four *edges;* the superior and more considerable of which, conjointly with the notch, gives attachment to a *broad ligament*, by which it is fixed to the under part of the os hyoides. The inferior edge is shorter and concave in the middle; while the posterior edges have an oblique direction, and are concave above and convex below; and are terminated at the corners by processes called *cornua*. The two *superior* of which are more or less lengthened, and have an oblique direction backwards; they are connected by round ligaments to the extremities of the cornua of the os hyoides. In the middle of these ligaments one or two small cartilaginous or osseous bodies are frequently found. The other two cornua, called *inferior*, are shorter, curved forwards, and fixed by smooth articulating surfaces to the sides of the cricoid cartilage.

CRICOID CARTILAGE. The cricoid, or *annular* cartilage, forms the inferior and posterior part of the larynx, and may be readily felt in the fore part of the throat. It is narrow before where it lies under the thyroid, and thick and broad posteriorly. Its external surface has, anteriorly, a convexity which is subcutaneous. Behind, where it is largest, it presents nearly a quadrilateral surface, upon the middle of which is a perpendicular ridge dividing it into two lateral cavities for the reception of the M. crico-arytænoidei-postici. The superior circumference is anteriorly hollowed out, to which part is attached the membranous ligament connecting it with the thyroid cartilage. The inferior circumference is nearly horizontal. It is connected to the first ring of the trachæa by a membranous ligament like that which connects the other rings. It has four small articular surfaces, two of which are situated above and behind for the articulation of the arytænoid cartilages, and the two others at the under and lateral parts for the connection of the inferior cornua of the thyroid cartilage. They are provided with capsular ligaments.

ARYTÆNOID CARTILAGES. These are two in number. Are much smaller than the other cartilages, and are placed upon the upper, posterior, and lateral parts of the cricoid cartilage at a small distance from each other. Their form is pyramidal. They have each a concavity on the posterior surface for the M. arytænoidei. Their *base* has an oval concave articular surface, covered by synovial membrane, which corresponds to an analogous surface on the cricoid cartilage, and posteriorly forms a triangular projection, which gives attachment to the ligament connecting it with the thyroid cartilage.

On the anterior surface of the arytænoid cartilages, is a glandular body, *arytænoid gland*, seemingly composed o fan aggregation of mucous glands.

EPIGLOTTIS. Is situated at the upper part of the larynx, between it and the tongue, and covers the opening of the larynx. It appears oval, but when divested of its membrane, its form is that of a purslain leaf; it is broad above close to the tongue and rounder, but narrows below, and terminates in a point. The upper surface next the tongue is convex, with its point reflected forwards, and it is covered by

the mucous membrane of the mouth, the membranes forming two loose folds at the sides, and a fold in the middle, called the *frænum epiglottidis*. The surface towards the glottis is concave and covered by the laryngeal membrane, fixed to the notch of the thyroid cartilage by a broad short ligament, and by two lateral ligaments, and by the membrane to the whole length of the arytænoid cartilages. It is of a ligamento-cartilaginous nature, and much more pliable than the other cartilages. It has numerous perforations like the pricks of a pin, which lodge a number of *mucous glands* covered by the membrane.

LIGAMENTS OF THE GLOTTIS. Besides those which have been mentioned, there passes from the projection of the base of each arytænoid cartilage a ligamentous cord, *lig. thyreo-arytænoideum,* horizontally forwards, to be fixed by its other extremity to the inside of the anterior angle of the thyroid cartilage. The opening formed between these ligaments is called the *mouth of the larynx, glottis,* and *rima glottidis;* it is of a triangular figure, the ligaments being in contact before but at a distance from each other at their posterior extremities. Under these two ligaments there are two others, larger and more distinct than the former, and considered as the *proper ligaments of the glottis.* These arise from the base of the arytænoid cartilages, run in the same direction as the former, and like the former are fixed to the thyroid cartilage. In the interstice of the superior and inferior ligament on each side, there is a fissure which leads to a small membranous cavity with its bottom turned out. These cavities are the *Sacculi Laryngis* or *Ventricles* of the larynx, of Galen.

The cavity of the larynx is lined by a MEMBRANE of a mucous nature continued from the mouth and pharynx, but less red. It is perforated by the mouths of small mucous glands.

The *Ligaments* belonging to the cartilages of the larynx may be enumerated as fourteen :—*one* broad and *two* round between the os hyoides and thyroid cartilage; *one* broad and *two* capsular between the thyroid and cricoid cartilages; *two* capsular between the cricoid and arytænoid cartilages; *one* broad between the cricoid cartilage and the first ring of the trachæa; *one* broad connecting the epiglottis to the root of the tongue; and the *four* chordæ vocales. And some reckon two ligaments connecting the epiglottis to the thyroid cartilage.

MUSCLES OF THE LARYNX. The larynx has a number of muscles for its different motions. These are of two kinds—the one common to it and other parts. They are: the sterno-thyroidei, thyreo-hyoidei, and constrict. pharyng. inferiores; together with those attached to the os hyoides, the movements of which are communicated to the larynx especially. The others proper to it are situated in what may be called the—

LARYNGEAL REGION. They are:—

1. M. CRICO-ARYTÆNOIDEUS POSTICUS.

Situation. On the back of the cricoid cartilage.

Origin. Fleshy from the posterior broad portion of the cricoid cartilage.

Insertion. Into the back part of the base of the arytænoid cartilage.

Use. To open the rima glottidis, and to tighten the chordæ vocales.

2. M. CRICO-ARYTÆNOIDEUS LATERALIS.

Situation. Covered partially by the ala of the thyroid cartilage, which must be removed to show it distinctly.

Origin. Fleshy from the side of the cricoid cartilage, concealed in a great measure by the thyroid cartilage.

Insertion. Into the side of the base of the arytænoid cartilage.

Use. To open the rima by pulling the vocal chords apart.

3. M. THYREO-ARYTÆNOIDEUS.

Situation. Covered by the thyroid cartilage.

Origin. From the middle of the internal surface of the thyroid cartilage.

Insertion. Into the arytænoid cartilage above the former muscle.

Use. To loosen the vocal chords by drawing the arytænoid cartilages forwards towards the thyroid.

4. M. ARYTÆNOIDEUS OBLIQUUS.

Situation. Extending from one arytænoid cartilage to the other.

Origin. From the base of one arytænoid cartilage, and crosses its fellow.

Insertion. Into the tip of the other arytænoid cartilage.

Use. To pull the arytænoid cartilages towards each other.

One or the other of these is frequently found wanting.

5. M. ARYTÆNOIDEUS TRANSVERSUS.

Situation. A single muscle running across from one arytænoid cartilage to the other.

Origin. From nearly the whole length of the side of one arytænoid cartilage. Its fibres pass transversely.

Insertion. In the same manner into the side of the other arytænoid cartilage.

Use. To bring the cartilages nearer each other, and shut the rima.

Besides these muscles there are some pale fibres which have been considered by some anatomists as distinct muscles, and are named:—

6. M. THYREO-EPIGLOTTIDEUS.

Situation. In the fold of membrane by the side of the frænum epiglottidis.

Origin. From the thyroid cartilage.

Insertion. Into the epiglottis laterally.

Use. To draw the epiglottis obliquely downwards, or, if both act, to pull it directly down.

7. M. ARYTÆNO-EPIGLOTTIDEUS.

Situation. In the fold of membrane extending between the epiglottis and arytænoid cartilages.

Origin. From the side and upper part of the arytænoid cartilage. It passes by the side of the opening of the larynx.

Insertion. Into the epiglottis.

Use. To pull that side of the epiglottis towards the rima glottidis; but if both act, to pull the epiglottis directly down.

CHAPTER V.

Of the Ear.

The Organ of Hearing is divided into the external and internal ear.

§ 1. OF THE EXTERNAL EAR.

The External Ear comprehends the Ear so called, that is, the EXTERNAL APPENDAGE OR AURICLE, and the MEATUS AUDITORIUS EXTERNUS.

Auricle. It has an irregular figure, and is distinguished into the pinna and lobus.

The Pinna is the larger and whole superior part; and its *external surface* is divided into different depressions and eminences, which have received particular names.

Eminences:—1. *Helix*, a nearly semi-circular eminence, which forms a rounded margin beginning at the lobe and terminating nearly opposite to its origin within the concha, which it divides; the portion extending across the concha is sometimes called *septum conchæ*. 2. *Anti-helix*, surrounds the concha, and is situated within the former, beginning by two eminences which coalesce. 3. *Tragus*, a small eminence lying over the meatus and connected to the under and fore part of the helix. It is covered by small hairs. 4. *Anti-tragus*. Opposite the former, less considerable and below the inferior extremity of the anti-helix.

Cavities:—1. *Fossa innominata*, situated between the helix and anti-helix. 2. *Scapha*, or *Fossa Navicularis*, situated between the two divergent extremities of the anti-helix. 3. *Concha*. Is the larger cavity bounded by the helix, tragus, anti-helix, and anti-tragus: divided into two parts by the termination of the helix, or septum conchæ. The upper and smaller is continued behind the helix with the fossa innominata, the lower and larger leads to the meatus externus.

The back part or inner surface of the pinna is irregularly convex.

The LOBUS is the inferior soft and pendent part of the ear; it is composed of cellular substance with a small quantity of fat.

The Auricle is covered by a continuation of the common integuments, which are thinner here than in most other parts of the body, and are perforated by the mouths of sebaceous follicles. A *cartilaginous* structure gives form to the pinna of the external ear, and sends an elongation to assist in forming the meatus. It is connected to the temporal bone by the common integuments, and by its muscles, and is furnished with ligamentous expansions which connect it to the zygoma, mastoid process, and lateral parts of the head.

Some small and generally indistinct muscles are situated on the cartilage. They are

1. M. *Helicis major*. Above the tragus, covering the beginning of the helix.
2. M. *Helicis minor*. On the transverse eminence which divides the concha.
3. M. *Tragicus*. On the tragus, beginning at the base of the tragus externally, and terminating at its apex.
4. M. *Anti-tragicus*. Occupies the space between the anti-tragus and anti-helix, beginning on the former and terminating on the latter by oblique fibres.
5. M. *Transversus auris*. Situated on the back part. It begins on the prominent part of the concha, and terminates on the outside of the anti-helix.

MEATUS AUDITORIUS EXTERNUS. In order to examine the course of the meatus, its anterior wall must be cut away as far as that portion which sustains the membrana tympani. It is situated between the mastoid process and glenoid cavity, and extends from the convexity of the concha to the membrana tympani. Its perpendicular section presents an oval figure. Its length somewhat varies, being in the fœtus only a bony ring, which in the adult becomes a tube of about an inch in length. Its course is slightly tortuous; it is first directed upwards and forwards, and then turns a little downwards and backwards, so that on the whole it is convex above and concave below. The turns, however, are so inconsiderable, that the bottom of the passage may be seen in a clear light by pulling the ear backwards.

The meatus externus is partly bony and partly cartilaginous. The cartilaginous part is continued from the concha, and is of an irregular figure. It has two or three fissures commonly, and at the upper and back part it is defective. At the fissures, and at the part where it is defective, its place is supplied by ligament, which serves to fix it to the bone. The osseous part is continued from the cartilaginous; and is the longer of the two. The canal is lined by a continuation of the common integuments, covered by a soft down and frequently by hairs of some length, more particularly at the entrance of the meatus; and upon it we may observe the mouths of sebaceous ducts and small pores belonging to the glandulæ ceruminosæ. The skin adheres but slightly to the cartilage, but is firmly united to the osseous part, upon which it becomes so thin as scarcely to be distinguished from the periosteum. It passes upon the membrana tympani, and covers its outer surface, so as to terminate in a complete cul de sac.—During putrefaction it may be drawn out entire.

At the upper and back part where the cartilage is defective, and under the skin, are lodged the CERUMINOUS GLANDS, *glandulæ ceruminosæ.* These are small oval bodies, of a yellowish red colour. They each open by a small *excretory duct* into the meatus.

§ 2. OF THE INTERNAL EAR.

The INTERNAL EAR comprehends the TYMPANUM and the LABYRINTH.

MEMBRANA TYMPANI. The tympanum is separated from the meatus by the *membrana tympani;* which is a firm transparent membrane of an oval form, having its circumference fixed in a groove of the bone, and its direction oblique, so that it faces forward and downward, rendering the meatus longer below than above. The membrana tympani is tense; but its middle presents a concavity towards the meatus, and a convexity towards the tympanum, to which the extremity of the malleus is attached. It is formed of three layers: an outer one, before described, of common integuments; an internal one, which is a continuation of the membrane lining the tympanum, and which it is difficult to separate; and a third, which is interposed between them, is the proper membrane, and considered to be muscular.

In order to examine the tympanum it is necessary to cut away its upper part.

OF THE TYMPANUM.

The *tympanum* is a cavity of an irregular figure, situated within the petrous portion of the temporal bone, at the extremity of the meatus, and above the glenoid cavity.

To its inner side is placed the labyrinth from which it is separated by an osseous septum, in which there are several eminences, and two remarkable openings, called the fenestra ovalis and fenestra rotunda.

The *fenestra ovalis* is situated at the upper, inner, and back part of the tympanum; its greatest diameter is horizontal. The upper and under edges are convex upwards. It communicates with the vestibule; but is filled by the base of the stapes, connected at its edge by a very delicate *membrane.* Superiorly, the fenestra ovalis is bounded by a *rounded eminence,* formed by the AQUÆDUCT OF FALLOPIUS, or *canalis stylo mastoideus.* Below, it is bounded by another and more considerable eminence, called the PROMONTORY. It is formed by the outer side of the vestibule and the beginning of the scala tympani. To the inner side and before the promontory is the extremity of the *thin bony plate,* over which the tensor tympani runs. Below the fenestra ovalis, at the under and back part of the promontory, is a smaller opening called

The *fenestra rotunda,* which is rather triangular than round. It is shut up by a membrane which prevents any communication between the tympanum and the cochlea.

Below, and a little anteriorly, is the foramen glenoideum, through which pass the nervus chorda tympani, and the M. externus mallei,

MASTOID CELLS. *Posteriorly,* at the upper part of the tympanum is an open short canal, directed obliquely downwards and backwards, which leads to a number of cells occupying the mastoid process, called the *mastoid cells.* These vary considerable in disposition, number, and size; but all communicate with one another. Near to and above this passage is a bony eminence, called *eminentia pyramidalis;* which is hollowed for the reception of a small muscle, the M. stapedius.

EUSTACHIAN TUBE. *Anteriorly,* the tympanum communicates with the EUSTACHIAN TUBE, or *iter a palato ad aurem.* This is directed obliquely inwards and forwards from the upper and fore part of the tympanum to the superior and posterior part of the opening of the nares, and terminates at its outer edge, above the palate. It is about an inch and a half in length. It is narrow and rounded at its origin within the tympanum, but becomes larger, and terminates in a projecting, wide extremity, with prominent sides. It is composed of a bony posterior part, and a cartilaginous and membranous anterior part. The bony part forms the posterior third of the canal. The other two thirds are formed by cartilage and membrane; of these the whole of the posterior, and a part of the anterior wall is formed by cartilage; but the fore part towards the extremity is composed of a dense membranous substance. It is lined by a continuation of the membrane of the pharynx and tympanum.

After maceration the holes in the tympanum are all open, but in the recent state most of them are closed—there are nine of them; *two* always open, viz. the mastoid and Eustachian holes; *three* closed by membrane, viz. the external meatus by the membrana tympani, the fenestra rotunda, and the fenestra ovalis, the latter of which is also filled up by the base of the stapes; *two* closed by tendons, viz. the opening of the canal of the M. tensor tympani, and that in the eminentia pyramidalis for the M. stapedius; and *two* closed by nerve, viz. the opening in the stylo mastoid canal through which the nervus chorda tympani enters into the tympanum, and the foramen glenoideum through which it passes out; the latter also gives passage to the tendon of the M. externus mallei.

OSSICULA AUDITUS. The tympanum contains four small bones called *ossicula auditus*, which extend across from the membrana tympani to the labyrinth. The bones are: —the MALLEUS, INCUS, STAPES, OS ORBICULARE: the three former named from their supposed resemblance to a hammer, an anvil, and a stirrup, and the latter from its roundness.

The MALLEUS consists of a round *head*, a small *neck*, a *manubrium* or handle, called also the long process, and two small processes, one in the neck which is long and very slender, called *processus gracilis;* the other in the upper end of the handle called *processus brevis*. The handle forms an angle with the neck, becoming gradually smaller and incurvated towards the extremity, which is connected with the membrana tympani.

The INCUS resembles a molar tooth with its roots widely separated; it is placed behind the malleus, towards the mastoid cells. It is divided into a body and two crura. The *body* consists of an articular surface which forms a cavity with two eminences for receiving the malleus. The *crura* are of unequal length. The shorter and superior is placed nearly horizontally, and is articulated in a little depression near the aperture of the mastoid cells. The ligaments which retain it allow a considerable degree of motion. The longer and inferior is more slender; its direction is nearly perpendicularly downwards, and parallel with the manubrium of the malleus: it is articulated with the os orbiculare, which is received into a slight cavity on its point, which is curved backwards and inwards.

The Os ORBICULARE is hardly as big as a millet seed; it is rather of an oval figure. It connects the incus and stapes, but is more firmly attached to the former, of which it has sometimes been considered a process.

The STAPES has a strong resemblance to a stirrup. It is divided into a head, crura, and base. The *head* is placed upon a short *neck*, and slightly excavated to receive the os orbiculare. The *crura* are bent; that which is nearest the mastoid cells is, however, most incurvated and longest. They are grooved on the inside, and a membrane occupying the area of the stapes is fixed in the groove. The *base*, situated a little higher than the head, is of an oval figure, and is adapted to the fenestra ovalis, with which it is connected by a delicate membrane.

These bones are articulated with each other by means of *capsular ligaments* proportioned to their size, and are covered by a delicate *periosteum*.

The bones are moved by four small muscles forming

The TYMPANAL REGION, of which three belong to the malleus and the other to the stapes.

M. TENSOR MEMBRANÆ TYMPANI.

Situation. In a small bony canal, parallel with the Eustachian tube.

Origin. From the cartilaginous portion of the Eustachian tube. The fibres are collected into a long round muscle, which passes through the canal above mentioned, and enters the tympanum by a slender round tendon. The tendon issuing through a small aperture, at an obtuse angle to the line of the muscle, makes a turn towards the manubrium of the malleus.

Insertion. Into the manubrium of the malleus, a little below the processus gracilis.

Use. To tighten the membrane by pulling the manubrium of the malleus inwards and upwards, and drawing the bone inwards.

M. EXTERNUS MALLEI.

Situation. External to the base of the skull, on the inner and back part of the glenoid cavity of the lower jaw; it is very difficult to find.

Origin. From the extremity of the spinous process of the sphenoid bone, and from the Eustachian tube. Takes its course backwards and outwards toward the glenoid fissure.

Insertion. By a short tendon into the processus gracilis of the malleus.

Use. To loosen the membrane by pulling the processus gracilis of the malleus inwards and downwards, and throwing the head outwards.

M. LAXATOR TYMPANI.

Situation. At the top of the membrana tympani, and is a very small muscle.

Origin. From the top of the bony ring to which the membrana tympani is attached.

Insertion. Into the top of the short process of the malleus.

Use. It loosens the membrane by pulling the short process outwards and upwards, after it has been tightened by the tensor.

M. STAPEDIUS.

Situation. Within the eminentia pyramidalis.

Origin. From the cavity of the eminentia pyramidalis, in which it is contained. It has a very short tendon, which passes through an opening in it.

Insertion. Into the posterior part of the neck of the stapes.

Use. Principally as a ligament, but it will pull the neck of the stapes upwards and backwards.

OF THE LABYRINTH.

The Labyrinth consists of the VESTIBULE, the COCHLEA, and the three SEMI-CIRCULAR CANALS.

VESTIBULE. The vestibule has, to the outer side, the tympanum; to the inner, the meatus auditorius internus; anteriorly, the cochlea; posteriorly, the semi-circular canals. The shape of the vestibule is irregularly spherical; it is about the size of a grain of barley. In it there are seven *openings*, which communicate with the neighbouring parts; viz.—1. To the outer side, the fenestra ovalis; but which is closed, as has been before described.—2. Above, there are two *openings* which communicate respectively with the vertical and horizontal semi-circular canals.—3. Behind, there are three; one communicating with the posterior, a second with the horizontal, and a third the common orifice of the vertical and oblique semi-circular canals.—4. At the fore and under part, a round hole, which communicates with one of the canals of the cochlea. At each opening is commonly a slight excavation. Besides these, near to the common orifice of the vertical and the oblique semi-circular canals, there is a small opening, more or less distinct, which is the beginning of a

canal, called the AQUÆDUCTUS VESTIBULI, which takes its course upwards, then backwards and downwards, and terminates on the posterior surface of the petrous portion of the temporal bone, behind the meatus, and half way between its upper edge and the diverticulum of the internal jugular vein. So that in the vestibule there are eight openings, of which seven are always open.

SEMI-CIRCULAR CANALS. Three in number.—They correspond below and behind to the mastoid cells, forming about three-fourths of a circle. They are named from their position or direction: viz.—1. *Vertical* or *superior*.—2. *Oblique* or *posterior*.—3. *Horizontal* or *exterior*. The VERTICAL forms its curve at the summit of the petrous portion, which it crosses transversely with its convex above. The OBLIQUE, inferior to the last, describes its curve on the occipital side of the petrous portion; its convexity placed below and outwards. The HORIZONTAL is the smallest; it has its convexity towards the mastoid process, and is directly above a portion of the stylo-mastoid canal. The canals have a calibre about the size of a common pin, and are of an elliptical figure. They each enlarge as they enter the vestibule, forming an *ampulla*, or *cavitas elliptica*. The orifices are only five in number, as has been described; the smaller extremity of the vertical joining with the small extremity of the oblique, and forming a common orifice. These are not closed by any membrane.

COCHLEA. Is so named from its resemblance to the shell of a snail. It is conical; but lies more inwards than the vestibule, and before the meatus internus; and has its direction obliquely downwards and outwards, so that its base is towards the meatus internus, while its apex faces outwards. The cochlea is constructed with a modiolus or central pillar, around which are wound a spiral tube, and a spiral lamina lying within the spiral tube, and dividing it into two canals. The MODIOLUS commences from the bottom of the meatus internus, by a concave plate, which is full of small holes, *foramina crybriformia*. They are the extremities of small bony tubes, which run from the base toward the apex, and communicate with each other. These being blended into a mass of a conical figure, form the modiolus and terminate on its sides. As they terminate, the modiolus diminishes, and at its apex becomes exceedingly slender. The *infundibulum* is an imperfect funnel, the apex of which meets that of the modiolus; its base is covered by the apex of the cochlea, which is called the *cupola*.

The Spiral Tube passes round the modiolus, making two turns and a half from the base to the apex, and gradually decreasing in capacity. The spiral lamina, (septum scalæ, lamina spiralis,) arises from the vestibule, and winds round the modiolus within the spiral tube. Its greatest breadth is at its origin, and gradually becomes narrower towards the apex of the cochlea. It is composed of two extremely thin plates of bone, united at the margin, from which a membranous substance, *zona cochleæ,* is reflected on each side. The termination of the lamina forms a *hamulus,* or small hook, projecting into the infundibulum. By the aid of the membrane, the lamina makes a complete septum, and divides the spiral tube into two canals, or gyri, one of which is called the scala tympani, from its having an aspect towards the tympanum; the other, the scala vestibuli, from its communication with the vestibule.

The scala tympani is nearer the base of the cochlea, and begins from the fenestra rotunda; but does not communicate with the tympanum, the aperture being shut by a membrane.

The scala vestibuli begins by an oval orifice, between the fenestra ovalis and the ampulla of the vertical canal. The scalæ run parallel with each other, and communicate only at the apex of the cochlea.

The aquæductus cochleæ is a minute canal, which begins at the under part of the scala tympani, near the fenestra rotunda. It descends, becomes larger, and terminates by a triangular opening upon the surface of the dura mater, in the foramen lacerum basis cranii.

The openings in the cochlea are three, *two* of which are always open, viz. the opening from the vestibule and that of the aqueduct of the cochlea; and *one* closed by membrane in the recent state, viz. the fenestra rotunda.

The Labyrinth is completely lined by membrane, upon which are expanded the extremities of the auditory nerve; and that part of the membrane which is found in the cochlea, and completes the canals, is called *Lamina Spiralis Membranosa.*

THE END.

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